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TASK FORCE DELAY STUDY. WILLIAM B. HARTSFIELD ATLANTA INTERNATI--ETC(U)
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1 OF 3
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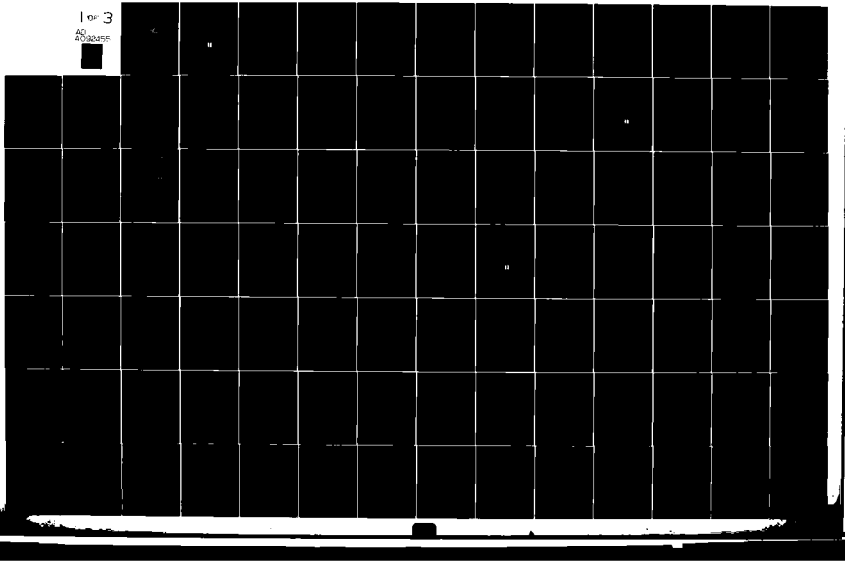

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William B. Hartsfield Atlanta International Airport, ~~Vol. II~~ V 1

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7. Author(s)
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East Point, GA 30320

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LEVEL III

AD A092455

16. Abstract

This report contains supporting documentation for the detailed analysis of the William B. Hartsfield Atlanta International Airport. The analysis was conducted by the Atlanta Airport Improvement Working Group which had representatives from the City of Atlanta, the Air Transport Association, the airlines serving Atlanta, and the Federal Aviation Administration. Technical support was provided by Peak, Marwick, Mitchell & Co., and the FAA Technical Center. The purpose of the analysis was to determine the causes of delay and the potential delay reduction benefits of recommended improvements. The effort was part of the Airport Improvement Program.

17. Key Words	18. Distribution Statement
Airfield Capacity Aircraft Delay Experimental Design Airfield Simulation Model	Document is available to the public through the National Technical Information Service Springfield, Virginia 22161

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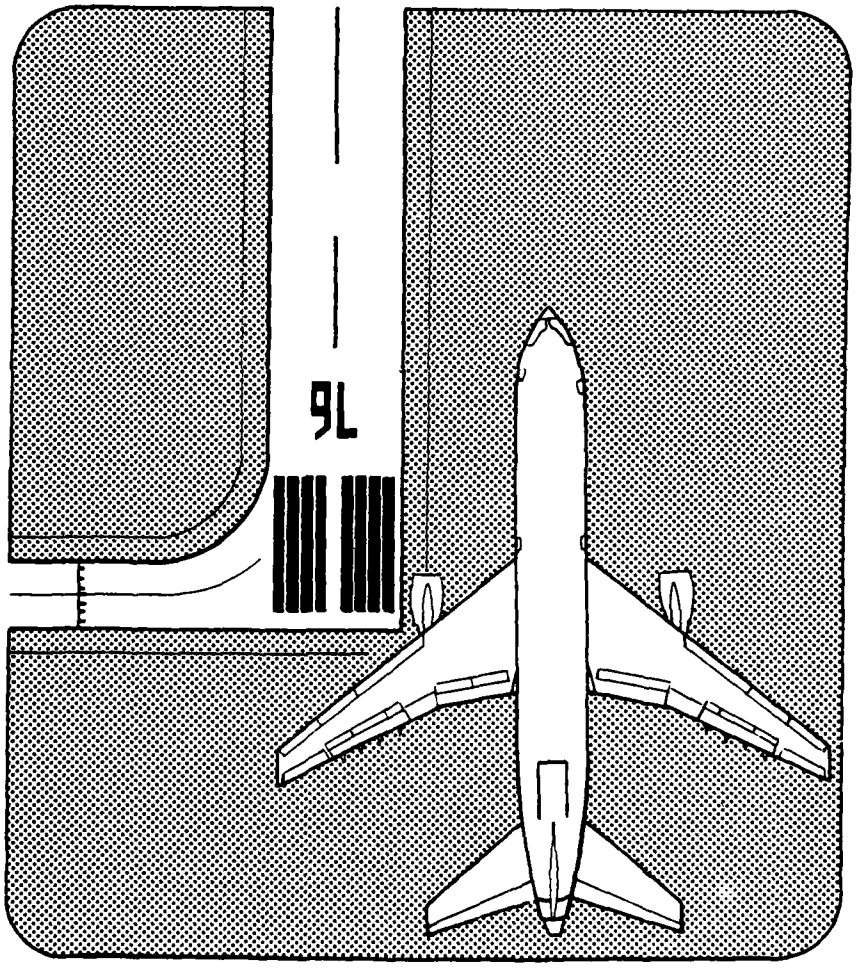
WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

DATA PACKAGE NO. 1

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES



prepared for

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

under contract

DOT FA77WA -3961

PMM&Co. Peat, Marwick, Mitchell & Co.

APRIL 1978

PEAT, MARWICK, MITCHELL & CO.
P. O. BOX 8007
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN FRANCISCO, CALIFORNIA 94128

Telephone: (415) 347-9521

April 14, 1978

Mr. Ray Fowler, AEM-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Re: Input Data for Atlanta Simulation Model Calibration and Annual Delay Baseline Experiment

Dear Ray:

Enclosed are some data materials for use during the second Task Force meeting on April 20, 1978:

- Attachment A contains the preliminary calibration data package. Additional data are required from NAFEC and the Task Force to complete this package.
- Attachment B contains the preliminary annual delay baseline data package.

These attachments contain information that should be reviewed, revised, and approved by the Atlanta Task Force prior to use in model runs.

Sincerely,

Stephen L. M. Hockaday
Manager

SLMH/nbe

Enclosure

cc: Mr. J. R. Dupree (ALG-312)
Mr. B. Drotts (ASO-4) (w/encl)

Attachment A

PRELIMINARY CALIBRATION DATA PACKAGE

WILLIAM B HARTSFIELD

ATLANTA INTERNATIONAL AIRPORT

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

April 14, 1978

INPUT DATA

A. LOGISTICS

1. Title: Atlanta International Airport Airfield Simulation Model Calibration Run

2. Random Number Seeds: 2017, 3069, 4235, 5873, 6981, 7137, 8099, 9355, 0123, 1985.

3. Start and Finish Times: 1430 to 1700.

4. Print Options: Detailed run for one random number seed. Summary run for ten random number seeds.

5. Airline Names:

Name	Code
Air Freight	AF
Air Taxi	AT
Braniff	BN
Delta	DL
Eastern	EA
Northwest	NW
Piedmont	PI
Southern	SO
Trans World	TW
United	UA

6. Processing Options: First run to check model input. Other runs in COMPUTE mode.

7. Truncation Limits: ± 3 standard deviations.

8. Time Switch: Not applicable.

B. AIRFIELD PHYSICAL CHARACTERISTICS

9. Airfield Network: See Figure 1.

10. Number of Runways: 3.

11. Runway Identification: 26, 27L and 27R.

12. Departure Runway End Links: 180, 238.

13. Runway Crossing Links: 191, 187, 202, 230, 353, 185, 354, 313, 347.

14. Exit Taxiway Location: To be based on existing airfield configuration and only those exits used during field data collection for calibration.

15. Holding Areas: Holding for (a) EA at north end of Runway 15, and (b) DL on taxiways P and R as appropriate.

16. Airline Gates: See Figure 2.

17. General Aviation Basing Areas: Two areas, one to west of terminal area and one to east of terminal area.

C. ATC PROCEDURES

18. Aircraft Separations: These values are based on capacity model data--may be revised as a result of reduced field data.

Arrival-Arrival Separation (n.m.) - All cases except as noted.

1. VFR

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	1.1	1.3	2.3	2.5
	B	1.1	1.3	2.3	2.5
	C	2.9	3.7	3.1	3.1
	D	4.1	5.1	4.7	4.1

2. IFR

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	3.0	3.0	3.3	3.5
	B	3.0	3.0	3.3	3.5
	C	4.5	4.5	3.3	3.3
	D	6.5	6.5	5.5	4.5

22. Vectoring Delays:

This input allocates delays among vectoring and holding. Model input values will be used that hold arrival aircraft if delays to arrival aircraft exceed 10 minutes.

23. Departure Runway Queue Control:

Aircraft are assigned departure runways to preclude airspace crossovers, not to balance departure queues.

24. Gate Hold Control:

Aircraft are held at gates when departure queue at runway is 10 or more, except when gate holds would cause gate congestion.

25. Departure Airspace Constraints:

Aircraft are not held at gates due to departure airspace constraints.

26. Inter-Arrival Gap:

With this runway use, arrival aircraft are delayed in the arrival airspace when departure delays exceed 10 minutes.

27. Runway Crossing Delay Control:

Arrival and departure runway operations are only interrupted for a taxiing aircraft to cross an active runway when the taxiing aircraft is delayed by 10 minutes or more.

D. AIRCRAFT OPERATIONAL CHARACTERISTICS

28. Exit Taxiway Utilization:

		Exit Utilization (percent)		
	A/C Class	GG	F	C
Runway 26	A	100		
	B	75	25	
	C			100
	D			100

		Exit Utilization (percent)			
	A/C Class	Y	X	W	U
Runway 26L	A	100			
	B		100		
	C			65	35
	D			20	80

29. Arrival Runway Occupancy Times:

	Runway Occupancy Time (seconds)			
	A/C Class	GG	F	C
Runway 26	A	48		
	B	41	50	
	C			60
	D			60

	A/C Class	Y	X	W	U
Runway 26L	A	37			
	B		48		
	C			45	65
	D			45	65

30. Touch & Go Occupancy Times:

Aircraft Class	Runway Occupancy Time (seconds) Mean	Standard Deviation
A	22	3
B	23	3
C	27	4
D	27	4

31. Departure Runway Occupancy Times:

Aircraft Class	Runway Occupancy Time (seconds) Mean	Standard Deviation
A	23	3
B	26	3
C	37	4
D	37	4

32. Taxi Speeds: To be based on reduced field data.

Departure-Departure Separations (seconds)

1. VFR

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	25	30	40	50
	B	30	40	45	50
	C	45	45	60	60
	D	120	120	120	90

2. IFR

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	60	60	60	60
	B	60	60	60	60
	C	60	60	60	60
	D	120	120	120	90

19. Route Data: See Figure 3.

20. Two-Way Path Data:

Two-way taxiways are located as follows:

1. Taxiway A.

2. Taxiway B between Taxiways V and P.

3. Taxiway F.

21. Common Approach Paths:

Arrival Runway	Aircraft Class	Length of Common Approach Path
26	A	3.0
	B	3.0
	C	5.0
	D	5.0
27L	A	3.0
	B	3.0
	C	5.0
	D	5.0

33. Approach Speeds:

Aircraft Class	Approach Speed (knots)	
	Mean	Standard Deviation
A	95	10
B	120	10
C	130	10
D	140	10

34. Gate Service Times: To be supplied by Task Force.

35. Airspace Travel Times: To be based on reduced field data.

36. Runway Crossing Times: To be based on reduced field data.

37. Lateness Distribution: To be supplied by Task Force.

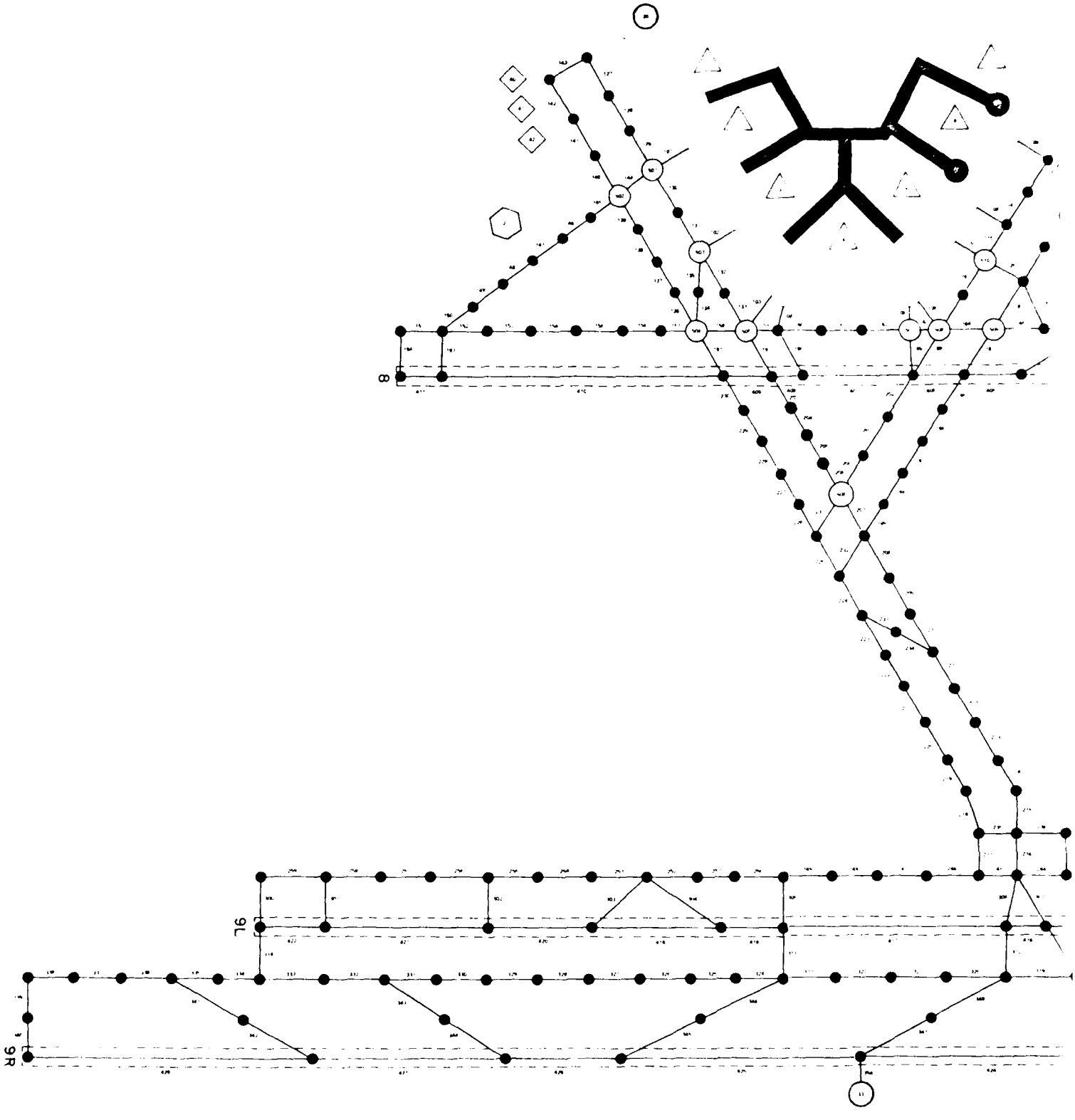
38. Demand: To be based on reduced field data.

OUTPUT DATA

A. FLOW RATES: To be based on reduced field data.

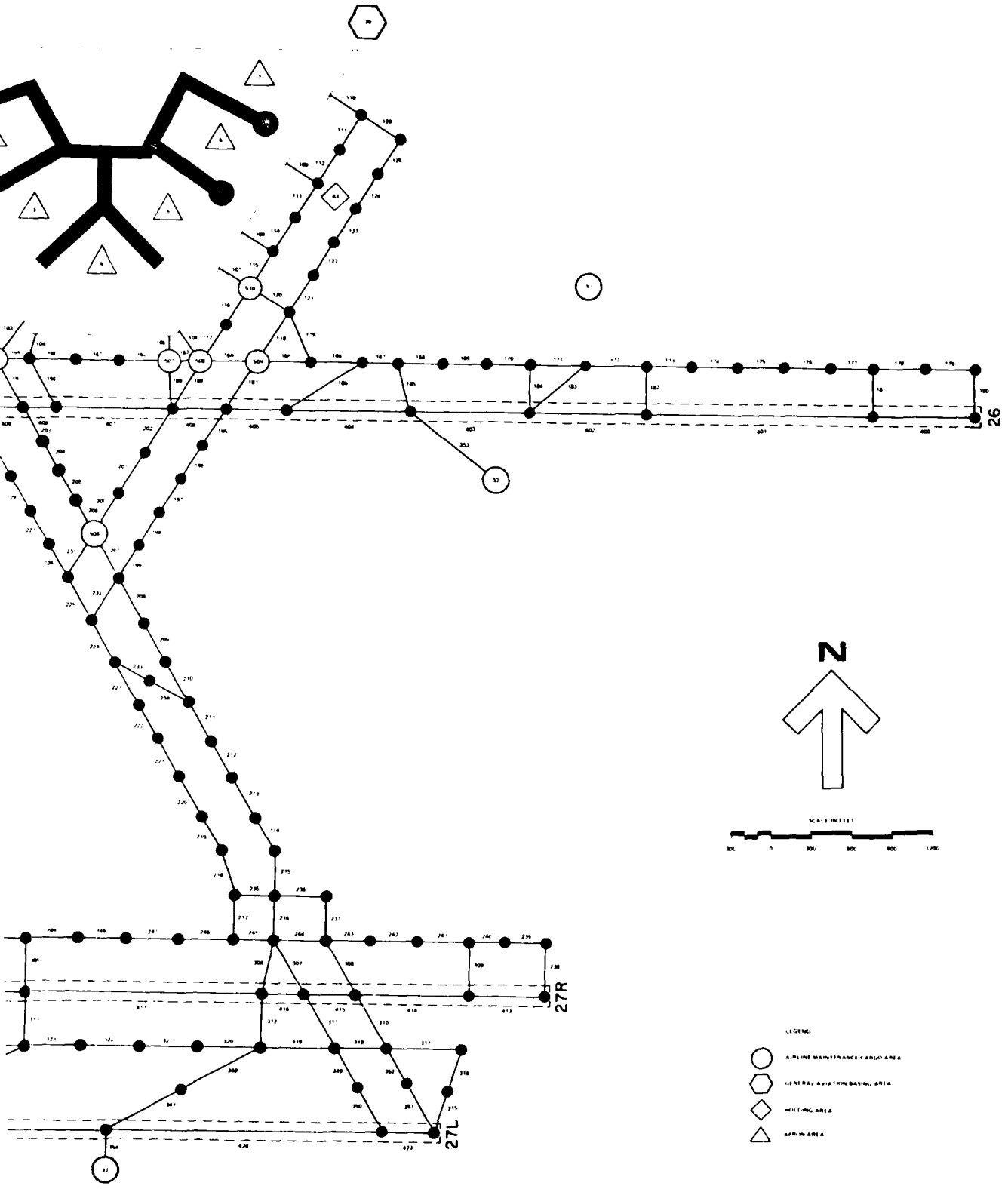
B. DELAYS: To be based on reduced field data.

C. TRAVEL TIMES: To be based on reduced field data.



AIRFIELD NETWORK

WILLIAM B. HARTSFIELD ATLANTA INTE



LD NETWORK

TLANTA INTERNATIONAL AIRPORT

Figure 1

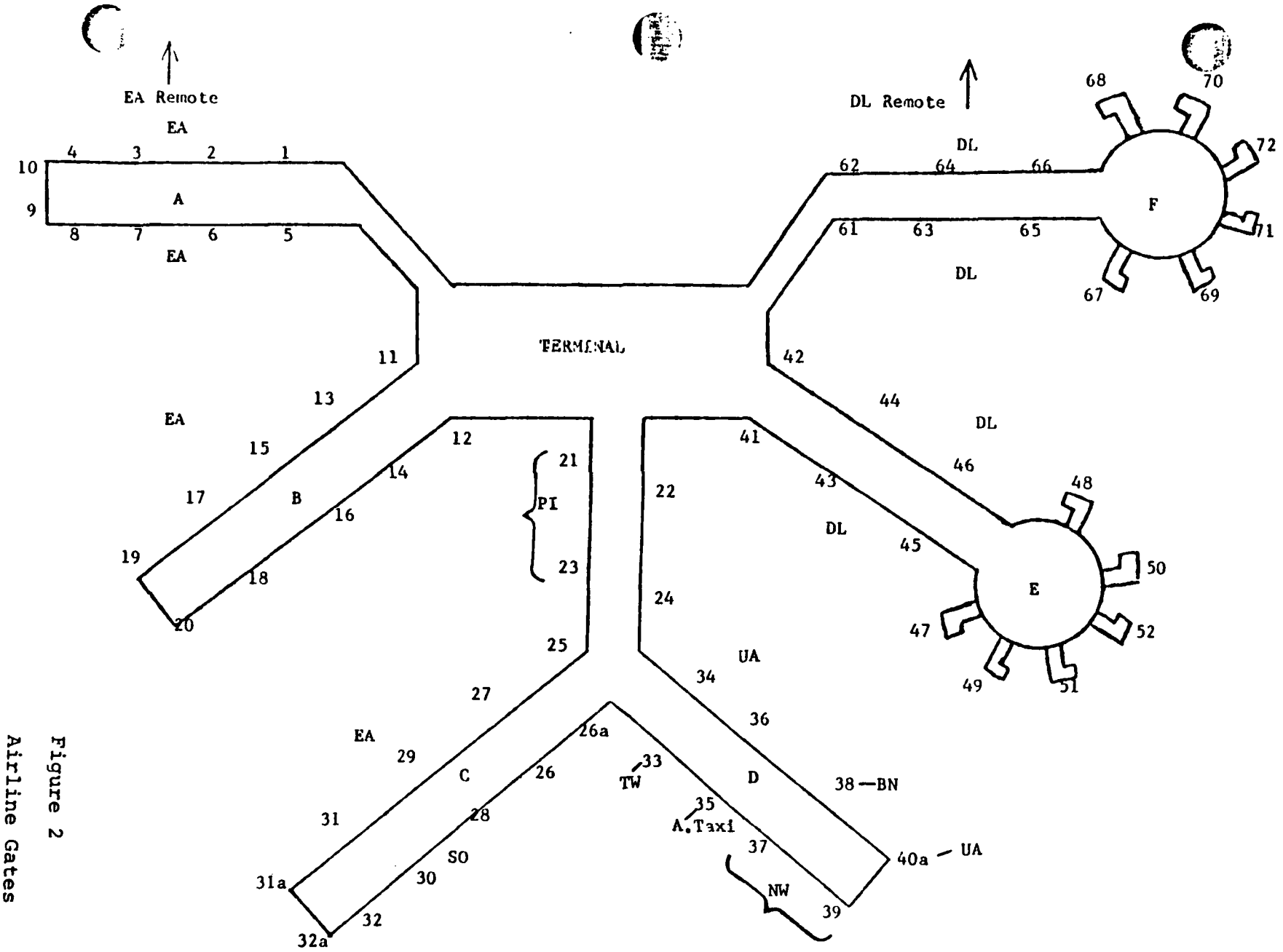


Figure 2

Airline Gates

Source: FAA

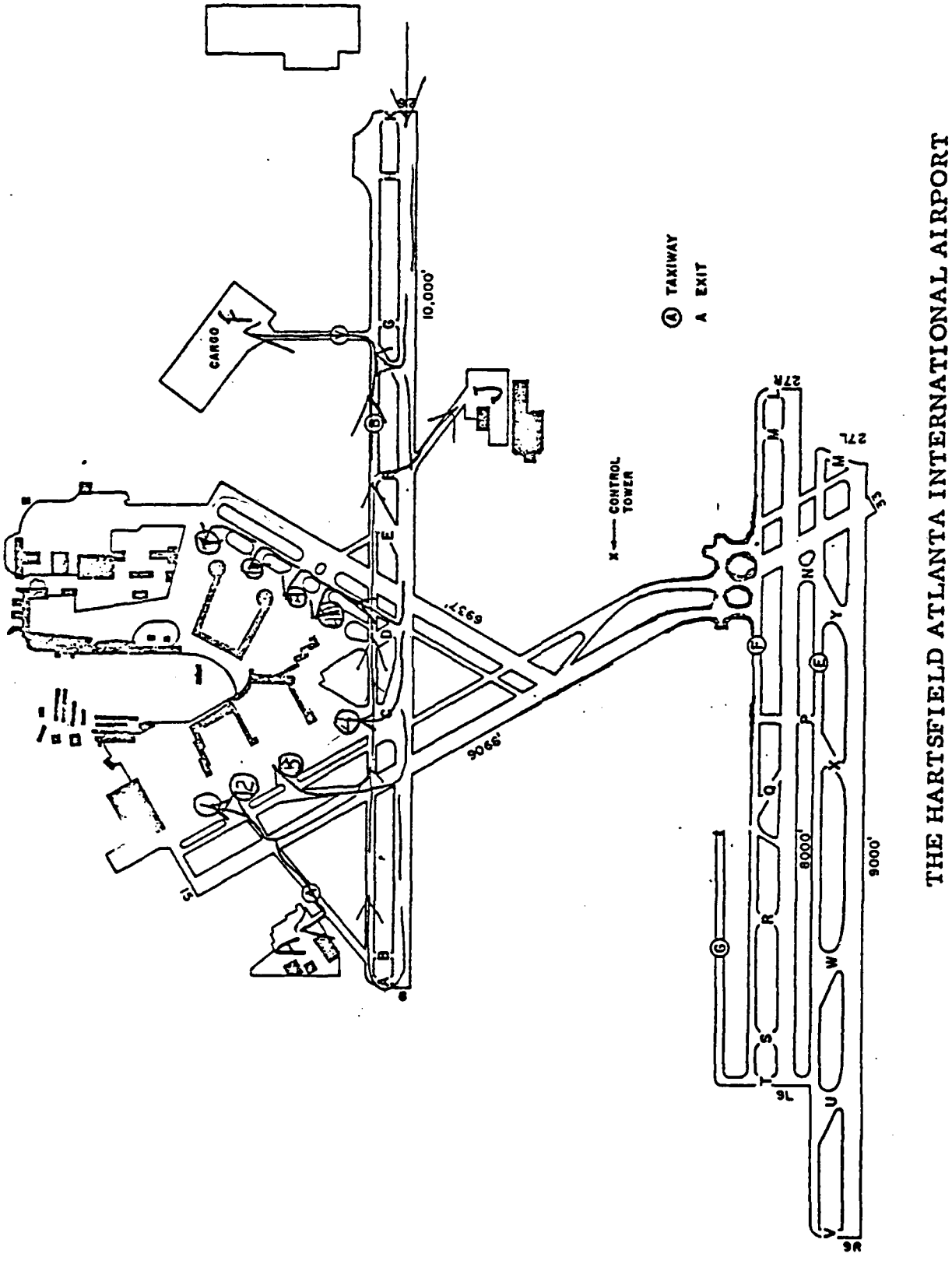


Figure 3a

Arrivals 26

Source: NAFEC

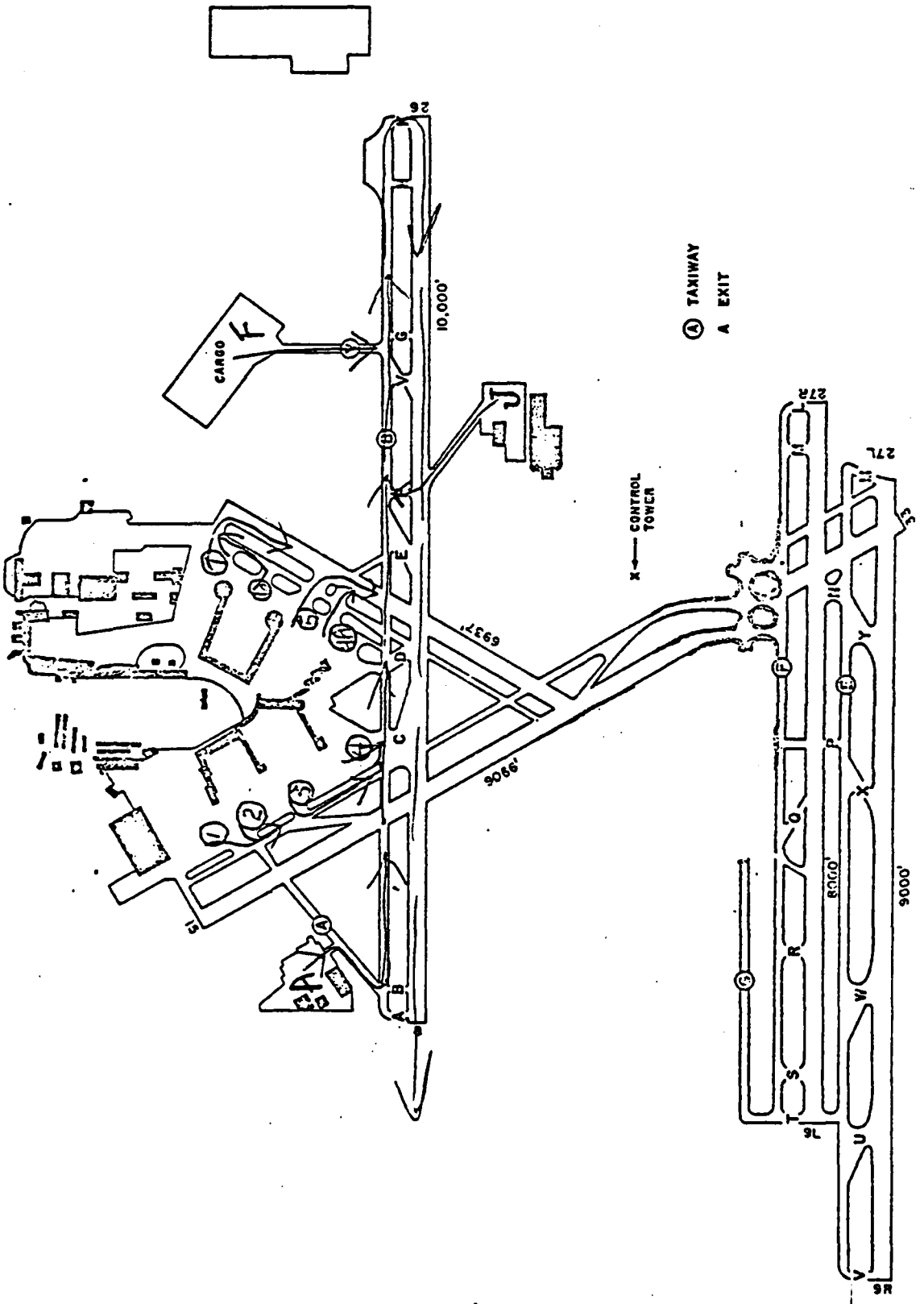


Figure 3b

Departures 26

Source: NAFEC

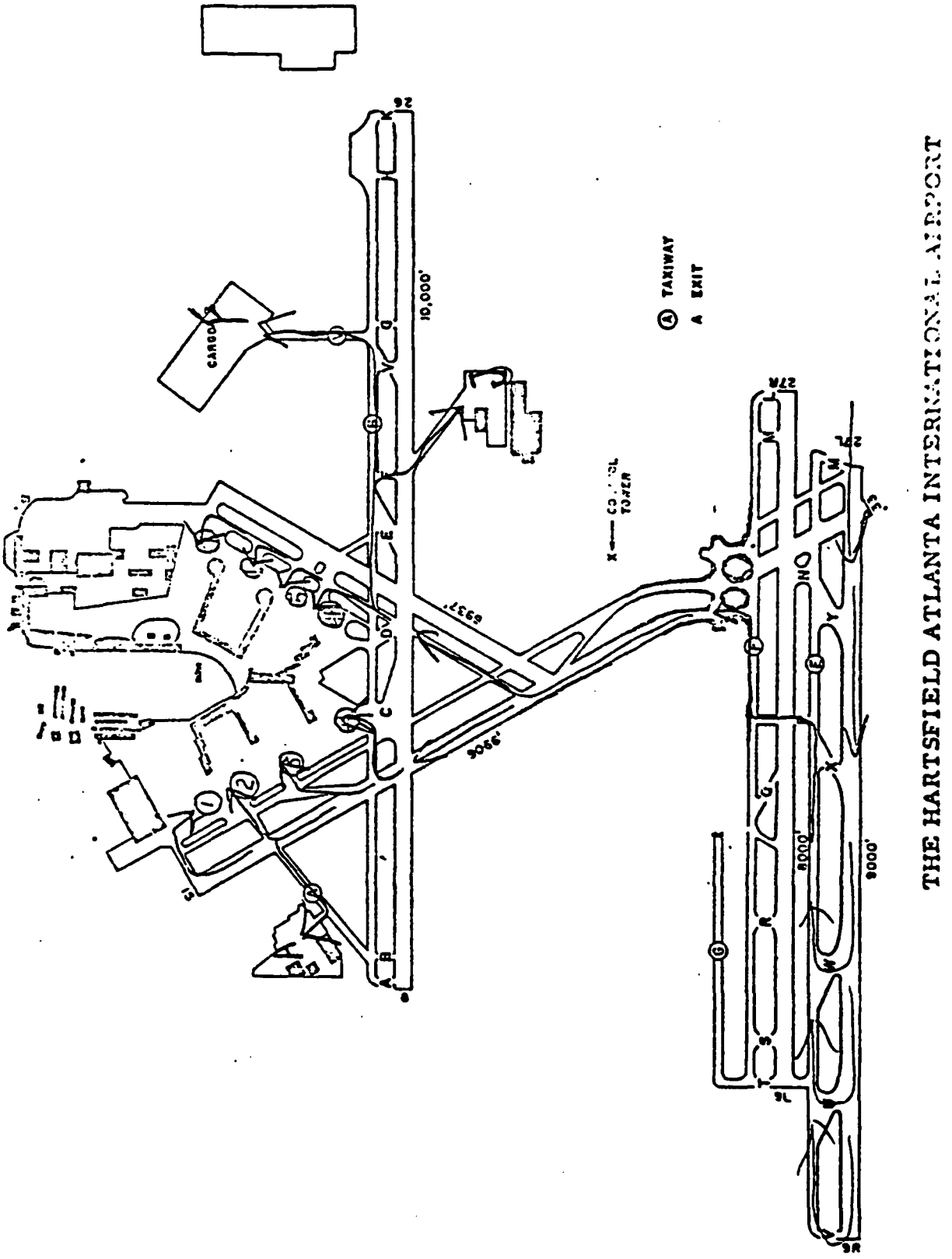


Figure 3c

Arrivals 27L

Source: NAFEC

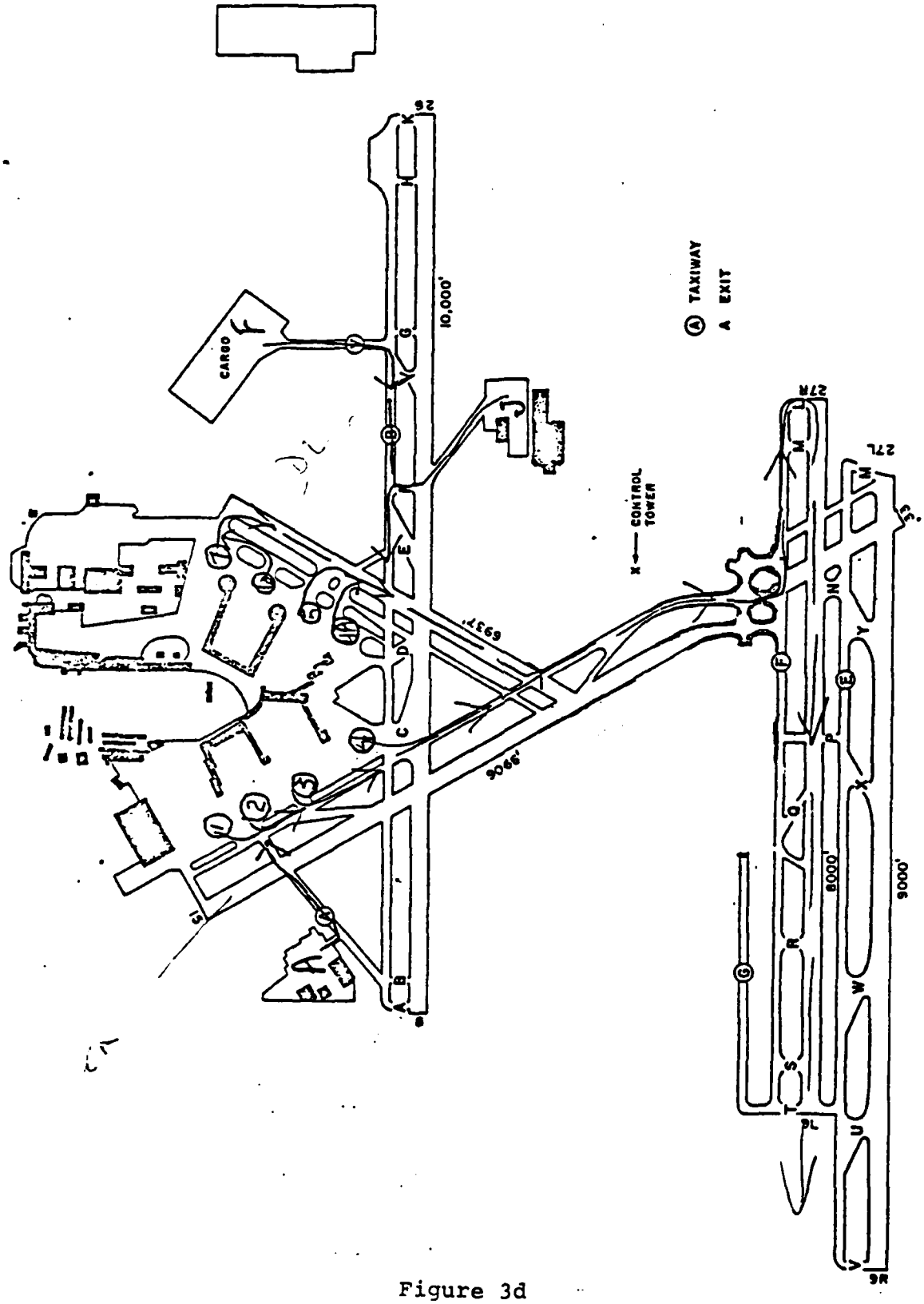


Figure 3d

Departures 27R

Source: NAFEC

Attachment B

PRELIMINARY ANNUAL DELAY BASELINE DATA PACKAGE

WILLIAM B HARTSFIELD

ATLANTA INTERNATIONAL AIRPORT

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

April 14, 1978

1. Annual Demand: 516,558 (1977)

2. Group Specification:

3 day groups	:	High, Average, Low
12 week groups	:	12 months, January through December
3 weather groups	:	VFR, IFR1, IFR2

2 runway uses	:	Arrivals Runway	Departures Runway
	1.	8, 9R	8, 9L
	2.	26, 27L	26, 27R

3. Weekly Traffic:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
% of annual in one week	1.83	1.86	1.88	1.90	1.90	1.91	1.90	1.98	1.95	1.95	1.96	1.98

4. Number of Weeks in Each Group:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
Number of weeks	4.43	4.00	4.43	4.29	4.43	4.29	4.43	4.43	4.29	4.43	4.29	4.43

5. Daily Traffic:

Day Group	1	2	3
% of weekly in one day	15.0	14.0	13.5

6. Number of Days in Each Group:

Day Group	1	2	3
Number of Days	3	2	2

7. Weather Group Demand Factors:

VFR:	1.00
IFR1:	1.00
IFR2:	0.90

8. Weather Occurrences:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
VFR	82	97	84	93	93	100	93	87	84	92	72	86
IFR1	15	3	16	7	7	0	7	13	16	8	22	11
IFR2	3	0	0	0	0	0	0	0	0	0	6	3

9. Hourly Runway Capacity:

Runway Use	Hourly Capacity		
	VFR	IFR1	IFR2
1	139	114	68
2	138	114	-

10. Runway Use Occurrences*:

Runway Use	Percent Occurrence		
	VFR	IFR1	IFR2
1	30.2	8.0	0.8
2	57.8	3.0	0.2

11. Hourly Traffic:

Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic
00-01	2.8	06-07	2.4	12-13	6.0	18-19	6.4
01-02	2.3	07-08	1.4	13-14	4.5	19-20	7.0
02-03	0.4	08-09	2.4	14-15	4.9	20-21	5.0
03-04	0.5	09-10	5.1	15-16	7.3	21-22	5.2
04-05	1.0	10-11	6.0	16-17	6.5	22-23	3.4
05-06	2.0	11-12	6.6	17-18	6.3	23-24	4.6

12. Demand Profile Factor: 30%

13. Runway Use Demand Factor:

All runway uses accommodate air carrier and general aviation demand (Demand factor = 1.0).

14. Aircraft Mix:
1% Class A
13% Class B
73% Class C
13% Class D

---

* PMM&Co. estimates based on 1977 PMS records.

15. Percent Arrivals:

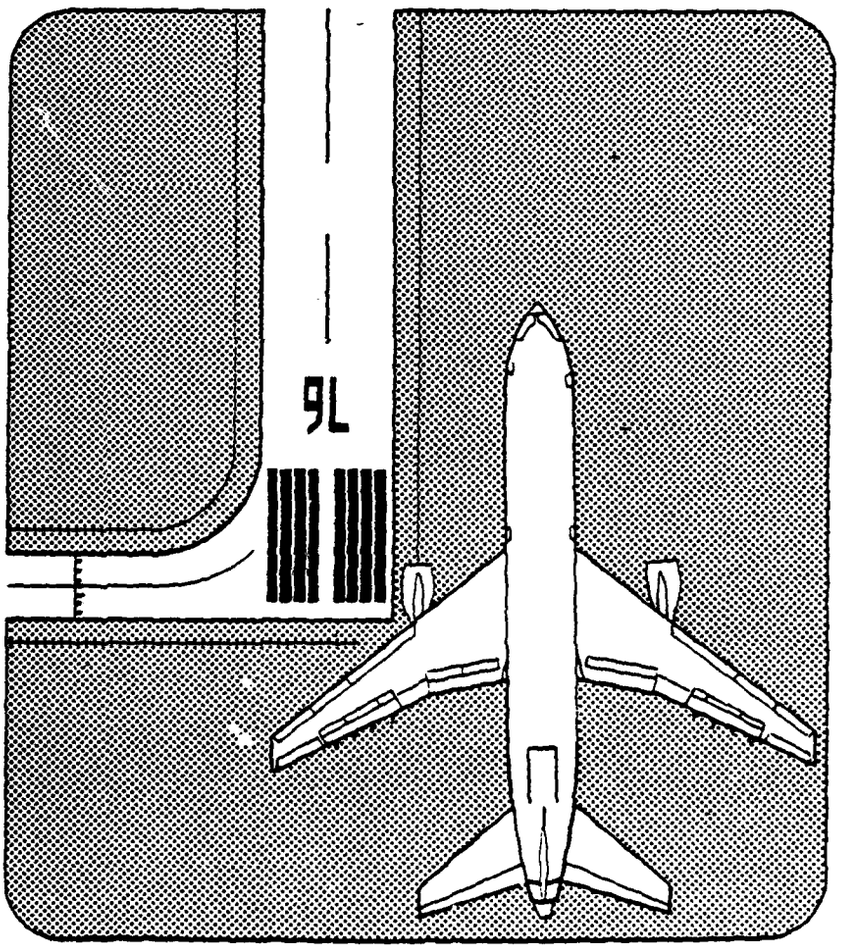
Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals
00-01	49	06-07	10	12-13	38	18-19	41
01-02	15	07-08	29	13-14	59	19-20	61
02-03	36	08-09	61	14-15	70	20-21	44
03-04	42	09-10	69	15-16	55	21-22	44
04-05	66	10-11	44	16-17	46	22-23	49
05-06	73	11-12	58	17-18	60	23-24	67

16. User-Specified Title: ATL ANNUAL BASELINE

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

DATA PACKAGE NO. 2

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES



prepared for

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

under contract

DOT FA77WA -3961

PMM&Co. Peat, Marwick, Mitchell & Co.

JULY 1978

PEAT, MARWICK, MITCHELL & CO.
P. O. BOX 8007
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN FRANCISCO, CALIFORNIA 94128
Telephone: (415) 347-9521

July 7, 1978

Mr. Ray Fowler, AEM-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Re: Atlanta Data Package No. 2

Dear Ray:

Enclosed are some data materials for use during the fourth Task Force meeting on July 12, 1978:

- Attachment A contains the results of the construction experiments. It should be pointed out to all concerned that these results are both preliminary, because they have not been reviewed or accepted by the Atlanta Task Force, and approximate, because they are derived from simplified "handbook type" analysis techniques and not from airfield simulation model runs.

- Attachment B contains the results of the four runway capacity experiments. Again, it should be pointed out that these results are preliminary and approximate.

- Attachment C contains the input data for the remaining Stage 1 experiments. This information should be reviewed, revised, and approved by the Atlanta Task Force before it is used in model runs.

Sincerely,

Stephen L. M. Hockaday
Manager

SLMH/nbe
Enclosure

cc: Mr. J. R. Dupree (ALG-312)
Mr. B. Drotts (ASO-4) (w/encl)

ATTACHMENT A

RESULTS OF CONSTRUCTION EXPERIMENTS

William B. Hartsfield
Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

July 1978

RESULTS OF CONSTRUCTION EXPERIMENTS

A manual analysis was performed to estimate the effects of the 36-hour closure of Runway 8/26 planned for later in the summer. The objectives of this analysis were to:

- Obtain order-of-magnitude estimates of the severity of delays that can be expected
- Identify the benefits of partial operation of Runway 8/26 for general aviation (propeller) aircraft
- Determine the best time of day to start the 36-hour closure

Figure A-1 shows the three alternative runway-use configurations that were considered. The left panel in Figure A-1 shows a baseline configuration with Runway 8/26 open. The middle panel shows two parallel runways plus propeller operations on Runway 8/26. In this case, propeller aircraft are assumed to land on one side of the construction area and to depart on the other side. The right panel in Figure A-1 shows the use of two parallel runways only.

Also shown in Figure A-1 are estimates of hourly runway capacities assuming 50 percent arrivals. Note that using Runway 8/26 for propeller aircraft (middle panel) yields a capacity increase of about 15 to 30 aircraft per hour.

The reason for the range of capacities associated with the "two parallels only" case is that, when both of these runways are used for arrivals, there are two alternative ATC procedures, shown as Procedures 1 and 2 in Figure A-2.

In Procedure 1, large (L) aircraft are flown on a course parallel to, but slightly ahead of, heavy (H) aircraft on the adjacent approach path. In Procedure 2, however, this L-H stagger is not allowed; instead, wake-vortex separations are provided behind the heavy aircraft. In other words, Procedure 2 treats the situation as a single channel.

Capacity estimates associated with the alternative runway-use configurations for the construction closure period are given in Table A-1 for various arrival percentages. It should be emphasized that these capacity estimates are only approximate, having been obtained using manual "handbook" methods.

A graphical comparison of these capacity figures as a function of arrival percentage is presented in Figure A-3. Curves C and D in Figure A-3 depict the capacity differences between ATC Procedures 1 and 2; Curve B shows the benefits of using the stub ends of Runway 8/26 for propeller aircraft.

A comparison was also made of these capacities against total hourly demand (arrivals and departures) by time of day. This comparison is shown in Figure A-4 where the various 50-percent-arrival capacities were superimposed on the profile of hourly weekday demand.

Figure A-4 was the basis for a deterministic queueing analysis of delays and queue lengths that can be expected during the construction period. This analysis was performed using a cumulative plot of total hourly demand at Atlanta International Airport and superimposing on that graph two alternative hourly runway capacities: (1) the Procedure 2 hourly capacity of 85 aircraft per hour, and (2) the minimum expected capacity of 66 aircraft per hour. It was assumed that delays associated with higher capacites, e.g., 99 aircraft per hour, are relatively small and stochastically generated, and not very sensitive to the start time of the closure period. From the resulting composite graph, one can measure (or compute):

- Total delay in aircraft hours
- Maximum and average delay
- Maximum and average queue length
- Length of congested period
- Number of aircraft delayed

Results of the deterministic queueing analyses are summarized in Table A-2 for various starting times of the 36-hour construction closure.

Deterministic queueing methods provide reasonable estimates in cases where these are periods of significant length, say several hours, during which the arrival rate is greater than the service rate. In such circumstances, the deterministic aspects of the queue formation overshadow the effects of stochastic fluctuations that occur in the arrival and service rates. On the basis of the foregoing considerations, it is thought that the deterministic queueing approach used herein is a reasonable one for obtaining estimates of the delay impacts of the Runway 8/26 closure and sensitivities to the starting time.

From the queueing and delay estimates, and other graphical solutions, we constructed an approximate graphical relationship between peak hourly delays and hourly runway capacity for Atlanta (see Figure A-5). This graph is probably most accurate for smaller values of capacity, say less than 90 aircraft per hour. Again, these capacity/delay estimates are only approximate; no high degree of precision is claimed for them.

Figure A-1

ATLANTA TASK FORCE DELAY STUDY
CONSTRUCTION EXPERIMENT CAPACITY ESTIMATES
(50 PERCENT ARRIVALS)

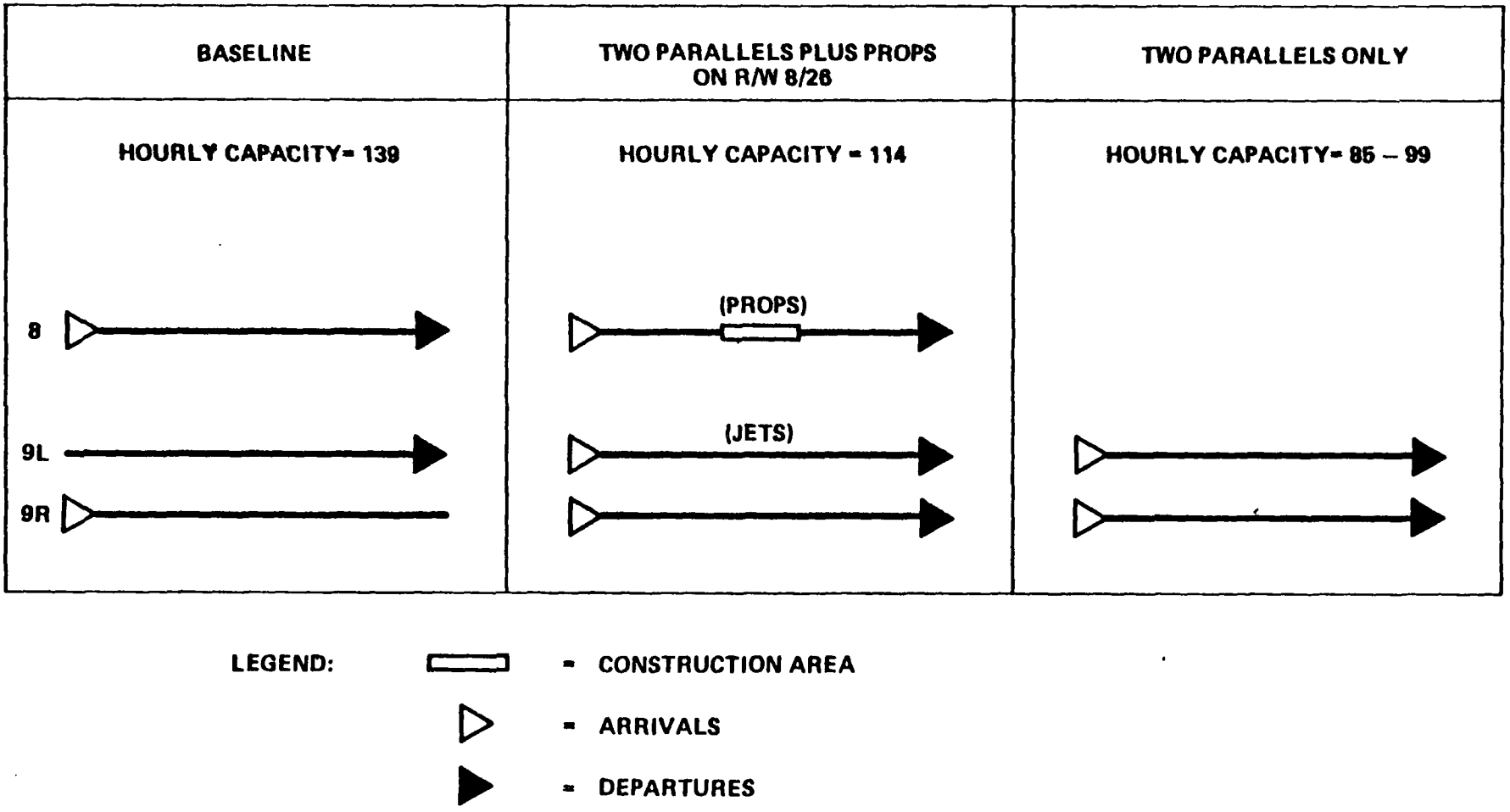


Figure A-2

ALTERNATIVE ATC PROCEDURES

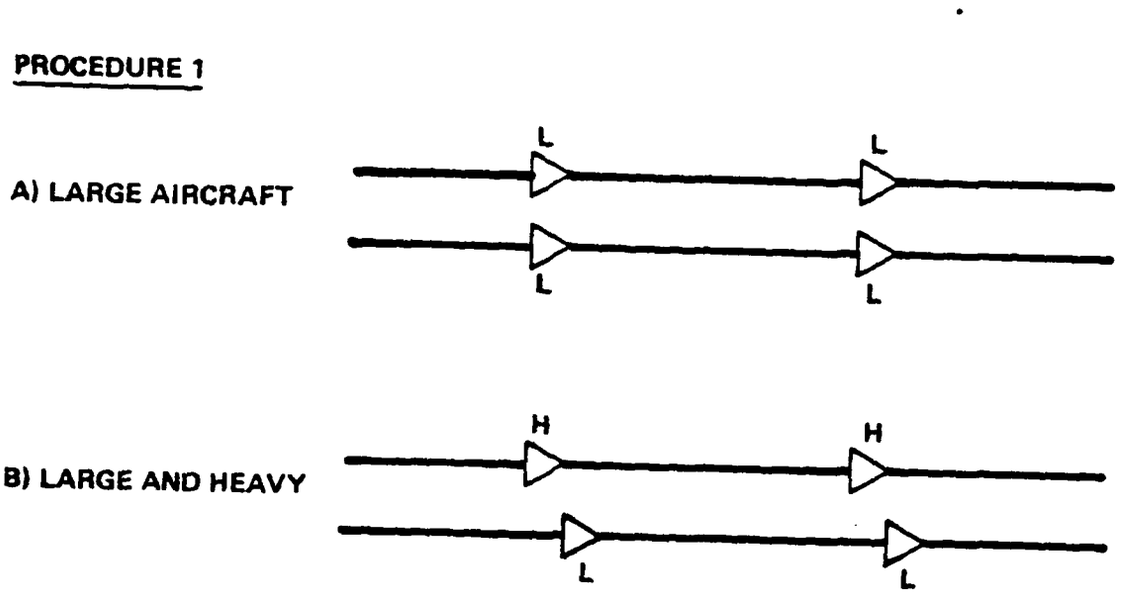


Table A-1

ATLANTA CONSTRUCTION EXPERIMENTS
ATLANTA TASK FORCE DELAY STUDY
Hourly Runway Capacity

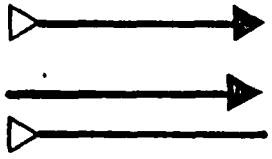
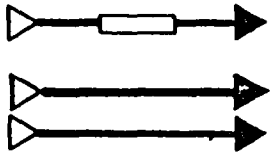
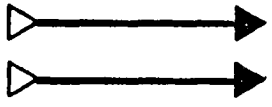
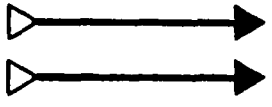
CASE DESCRIPTION			PERCENT ARRIVALS										
			0	10	20	30	40	50	60	70	80	90	100
Ⓐ	THREE RUNWAY BASELINE		106	117	132	145	144	144	132	113	99	88	79
Ⓑ	PROPS ON 8 JETS ON 9L 9R		106	114	114	114	114	114	114	114	90	90	90
Ⓒ	ALL ON 9L, 9R (PROCEDURE 1)		101	101	100	100	99	99	98	98	95	85	76
Ⓓ	ALL ON 9L, 9R (PROCEDURE 2)		84	84	84	85	85	85	85	85	83	73	66

Figure A-3
ATLANTA TASK FORCE DELAY STUDY
CONSTRUCTION EXPERIMENT
CAPACITY ESTIMATES

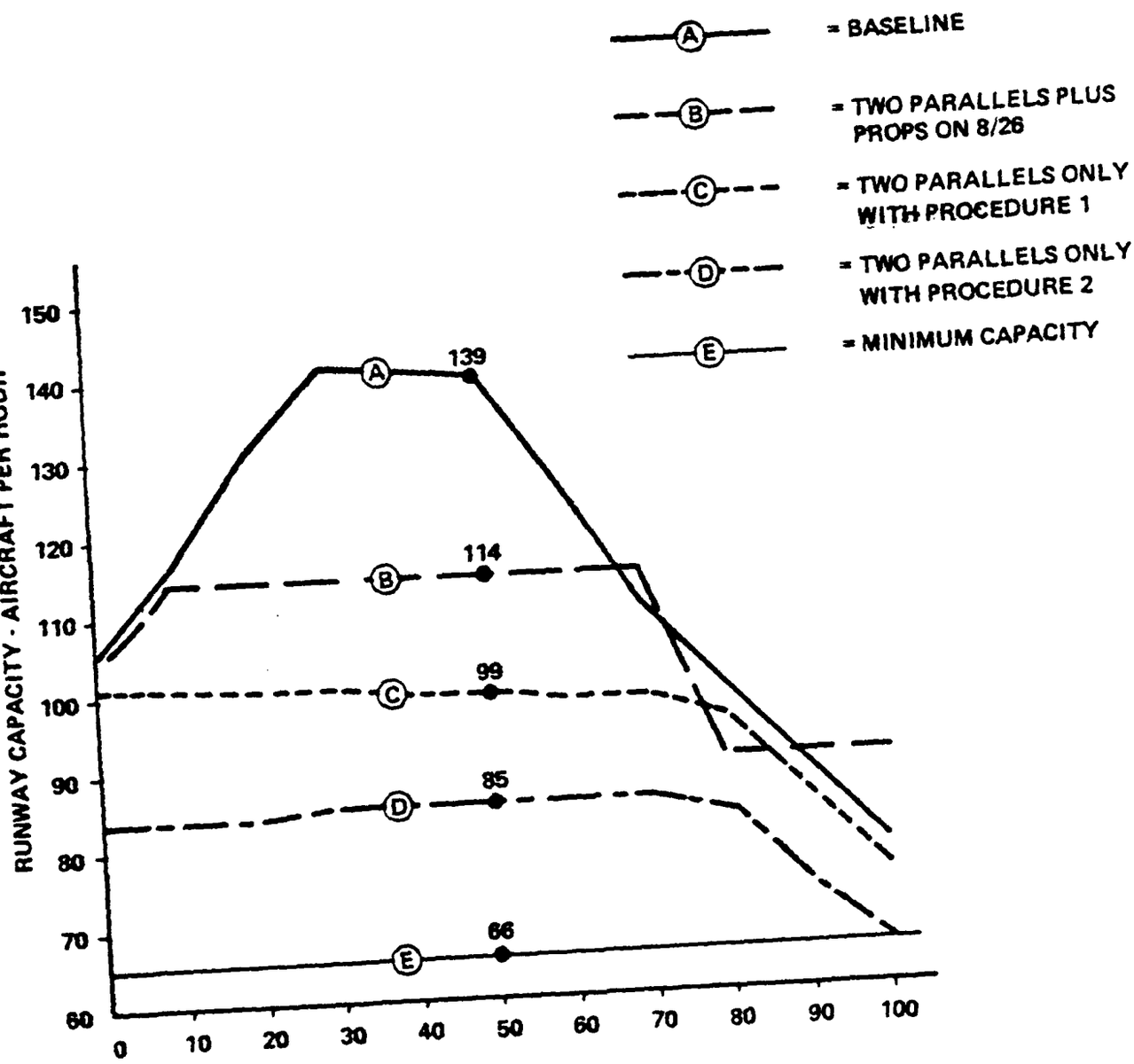


Figure A-4 (1)

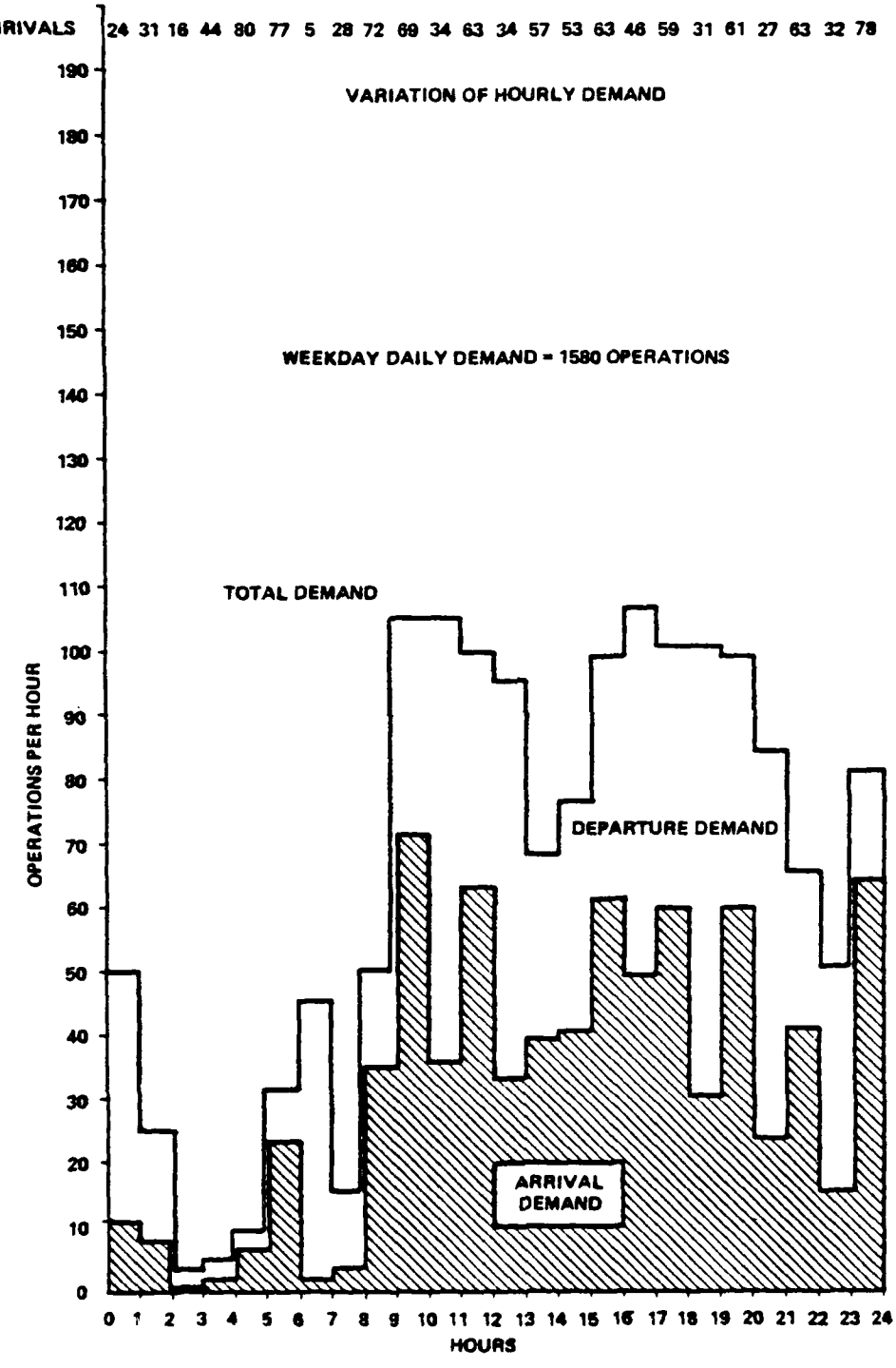

% ARRIVALS
24 31 16 44 80 77 5 28 72 69 34 63 34 57 53 63 46 59 31 61 27 63 32 78
VARIATION OF HOURLY DEMAND
WEEKDAY DAILY DEMAND = 1580 OPERATIONS
TOTAL DEMAND
DEPARTURE DEMAND
ARRIVAL DEMAND
OPERATIONS PER HOUR
HOURS
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Figure A-4 (2)
COMPARISON OF DEMAND WITH
CAPACITY DURING CONSTRUCTION

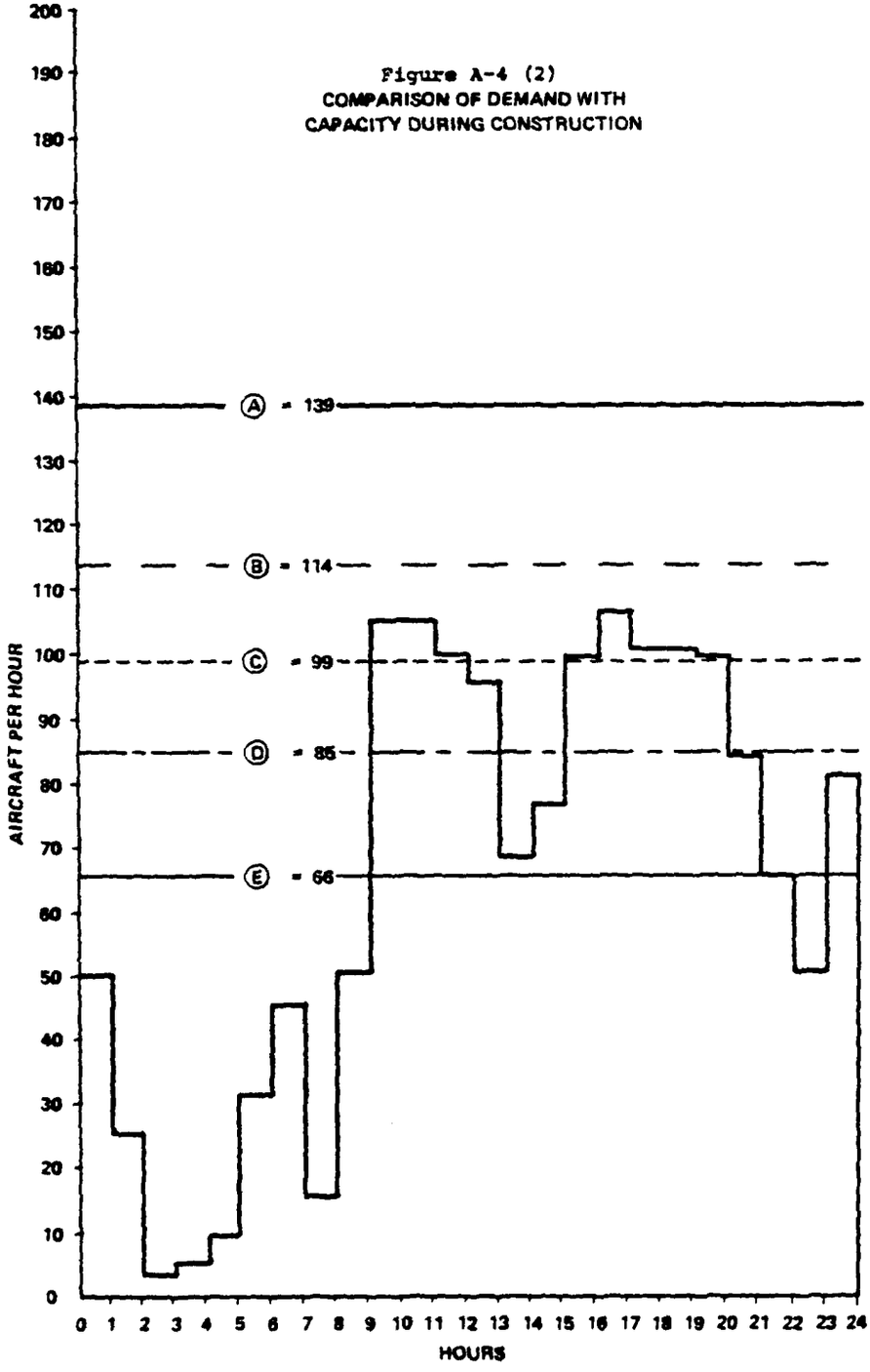


Table A-2

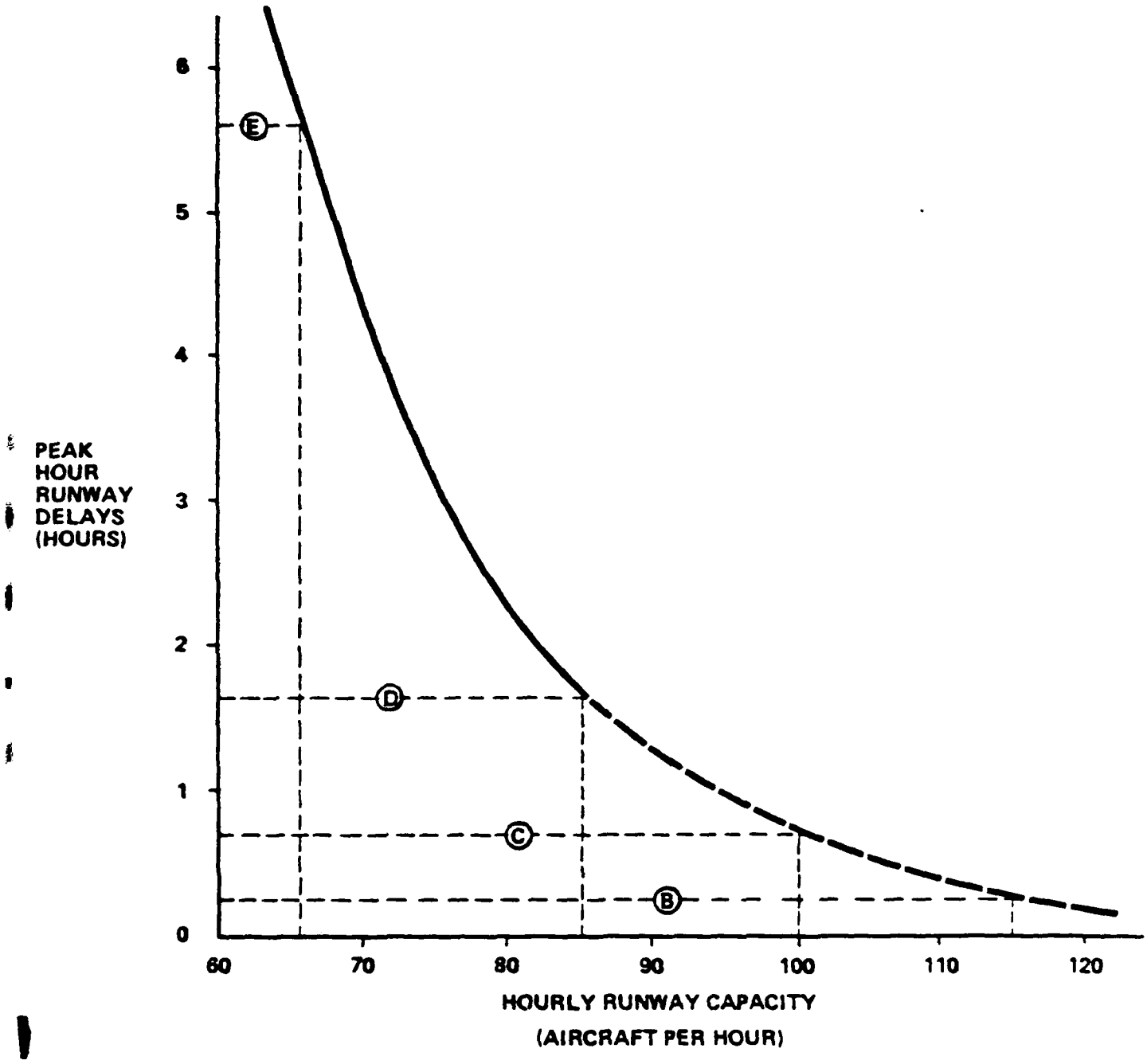
DETERMINISTIC QUEUEING ANALYSIS OF
36-HOUR CONSTRUCTION CLOSURE OF RUNWAY 8/26
Atlanta Task Force Delay Study

(1) Assumed capacity (aircraft/hr)	(2) Start time (EDT)	(3) Total delay (aircraft-hr)	(4) Avg.[a]/Peak delay (hr)		(5) Avg.[a]/Peak queue (aircraft)		(6) Length of congestion (hr)	(7) Number of aircraft delayed
66	0	5,100	2.5	5.4	175	356	29	2,060
66	4	6,140	2.2	5.4	187	356	37	2,790
66	8	7,560	2.5	5.4	188	356	40	2,990
66	12	6,350	2.4	5.5	161	363	39	2,680
66	16	5,890	3.0	5.5	156	363	38	1,970
66	20[b]	4,800	2.4	5.5	132	363	36	2,030
66	24[c]	5,240	2.5	5.5	178	363	29	2,080
85	0	1,500	0.8	1.7	71	144	21	1,850
85	4	1,830	0.8	1.7	70	144	26	2,360
85	8	2,300	0.9	1.7	77	144	30	2,630
85	12	1,790	0.7	1.7	62	144	29	2,480
85	16	1,620	0.8	1.7	65	144	25	2,100
85	20[b]	1,300	0.9	1.7	77	144	17	1,410
85	24[c]	1,470	0.8	1.7	69	144	21	1,860

a. Averages were computed by dividing Column (3) by Columns (6) and (7).
b. Indicates best start time to the nearest 2 hours.
c. Indicates that start times 0 and 24 should agree; this was a check on the calculations.

Figure A-5

ATLANTA CONSTRUCTION EXPERIMENTS
VARIATION OF RUNWAY DELAYS WITH CAPACITY



ATTACHMENT B

FOUR-RUNWAY CAPACITY EXPERIMENTS
(Numbers 7 through 11 of Technical Plan)

William B. Hartsfield
Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

July 1978

FOUR-RUNWAY CAPACITY EXPERIMENTS

The PMM&Co. runway capacity model (RCM) was applied to evaluate alternative ways of operating a four-runway configuration (Runways 8/26 and Runways 9/27) at Atlanta International Airport. Four 4-runway cases were analyzed, as shown in Figure B-1. Table B-1 contains hourly runway capacities for each case as a function of the percentage of arrivals.

The first three cases correspond to Stage I Experiments 7, 9, and 10 of Table III-2 of the Atlanta Technical Plan. From a capacity point of view, Experiments 7 and 8 are the same, although there are differences in the airfield operations of Experiments 7 and 8 (mainly differences in taxiways crossing runways). Similarly, Case 3 applies, from a capacity standpoint, to both Experiments 10 and 11 of the Technical Plan. Case 2, however, applies only to Experiment 9.

One additional experiment, not called for in the Technical Plan, is provided as Case 4 of Figure B-1 and Table B-1. This is the all-operations-on-all-runways configuration that might apply for very short, peak-directional time intervals. All of these experiments are for the pre-1985 demand and ATC system scenario under VFR1 weather with the 8L/26R near-term improvements.

Figure B-1

ATLANTA FOUR RUNWAY EXPERIMENTS

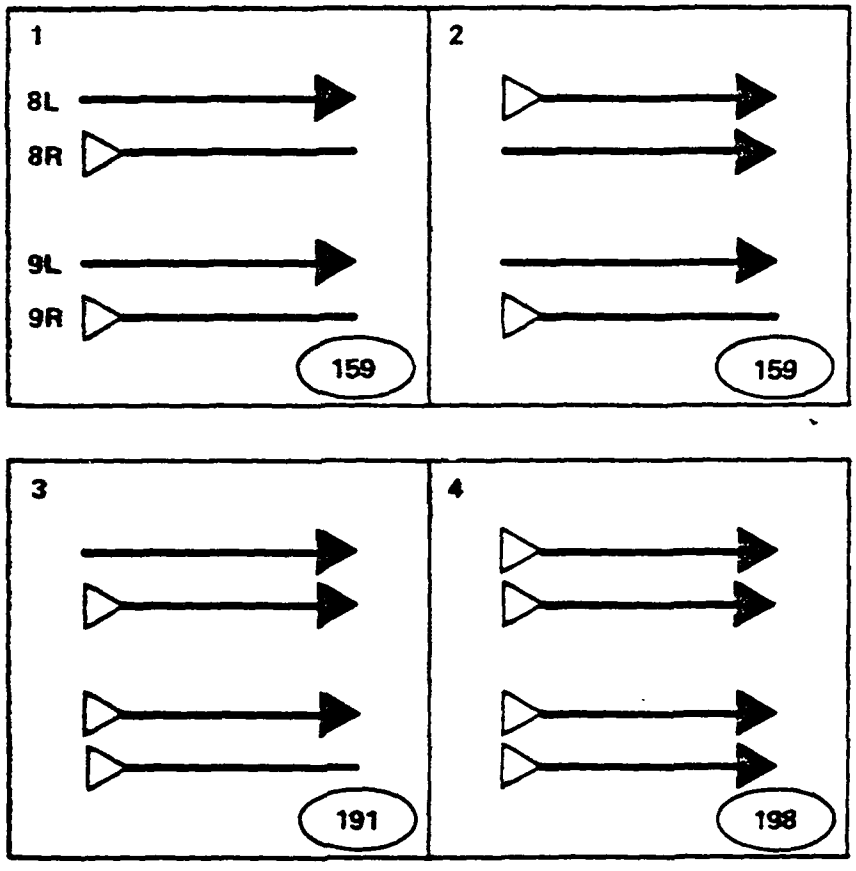
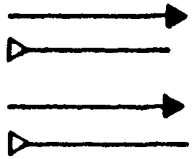
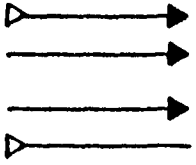
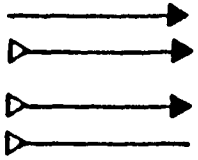
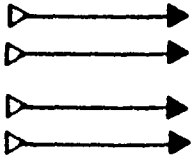


Table B-1

ATLANTA FOUR RUNWAY EXPERIMENTS
HOURLY RUNWAY CAPACITY

CASE	ARRIVALS	DEPARTURES	CASE	PERCENT ARRIVALS										
				0	10	20	30	40	50	60	70	80	90	100
1	8R, 9R	8L, 9L		106	117	132	151	176	159	132	113	99	88	79
2	8L, 9R	8L, 8R, 9L		151	168	189	191	193	159	132	113	99	88	79
3	8R, 9L, 9R	8L, 8R, 9L		151	168	189	191	191	191	191	166	145	129	116
4	8L, 8R 9L, 9R	8L, 8R 9L, 9R		202	202	200	200	198	198	196	196	190	170	152

ATTACHMENT C

DATA FOR REMAINING STAGE I EXPERIMENTS

William B. Hartsfield
Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

July 12, 1978

ATLANTA STAGE I EXPERIMENTS

At the third Atlanta Task Force meeting on June 14, 1978, a number of changes were made to the list of Atlanta Delay Experiments that was contained in Table III-2 of the January 1978 Technical Plan. Attachment B of this data package covered Experiments 7 through 11 of the original list. The remaining Stage I experiments, as modified at Atlanta Task Force Meeting No. 3, are the subject of this attachment. More precisely, input data for the following Stage I Experiments are presented herein:

Seq. no.	Experiment* no.	Model	Arrival runways	Departure runways	Weather	Demand	Comments
1	1	ASM	8, 9R	8, 9L	VFR1	Pre-1985	
2	2	ASM	8, 9R	8, 9L	IFR1	Pre-1985	
3	1A	ASM	8, 9R	8, 9L	VFR1	1978	baseline
4	2A	ASM	8, 9R	8, 9L	IFR1	1978	baseline
5	3	ASM	9R	8, 9L	IFR2	Pre-1985	
6	5	ASM	8, 9R	8, 9L	IFR1	Pre-1985	2.0 n.m. stagger
7	6	ASM	8, 9R	8, 9L	IFR1	Pre-1985	1.5 n.m. stagger
8	12	ADM	n.a.	n.a.	n.a.	1978	Only one in Stage I

*Refers to Original Technical Plan. No. contained in the Minutes of Atlanta Airport Improvement Study, Task Force Meeting No. 3, June 14, 1978.

All other aspects of the Stage I Experiments, e.g., ATC System Scenarios and Near-Term Improvements, are as specified in Table III-2 of the Technical Plan.

Input data for each of the foregoing list of experiments are presenced in the remainder of this attachment.

INPUT DATA FOR EXPERIMENT NO. 1

A. LOGISTICS

1. Title: Atlanta International Airport Airfield Simulation Model: Stage I Experiments

2. Random Number Seeds: 2017, 3069, 4235, 5873, 6981, 7137, 8099, 9355, 0123, 1985.

3. Start and Finish Times: 0830 to 2100 EDT.

4. Print Options: Summary run for ten random number seeds.

5. Airline Names:

Name	Code
Air Freight	AF
Air Taxi	AT
Braniff	BN
Delta	DL
Eastern	EA
Northwest	NW
Piedmont	PI
Southern	SO
Trans World	TW
United	UA

6. Processing Options: First run to check model input. Other runs in COMPUTE mode.

7. Truncation Limits: $\pm$ 3 standard deviations.

8. Time Switch: Not applicable.

B. AIRFIELD PHYSICAL CHARACTERISTICS

9. Airfield Network: See Figure C-1.

10. Number of Runways: 3.

11. Runway Identification: 8, 9L, 9R.

12. Departure Runway End Links: 194, 300.

13. Runway Crossing Links: 188, 192, 195, 203, 310, 313.

14. Exit Taxiway Location:

Runway	Taxiway	Link	Distance from Threshold (feet)
8	E	186	4,890
8	F	185	5,760
8	V	184	6,650
8	G	182	7,530
8	H	181	9,250
8	K	180	10,010
9R	X	345	4,680
9R	Y	347	6,580
9R	M	351	9,000

15. Holding Areas: Holding for (a) EA at north end of Runway 15, and (b) DL on taxiways P and R as appropriate.

16. Airline Gates: See Figure C-2.

17. General Aviation Basing Areas: Two areas, one to west of terminal area and one to east of terminal area (see Figure C-1).

C. ATC PROCEDURES

18. Aircraft Separations: These values are based on Report No. FAA-EM-78-8.

Arrival-Arrival Separation (n.m.) - All cases except as noted.

VFR

		Trail Aircraft Class A	B	C	D
Lead Aircraft Class	A	1.9	1.9	1.9	1.9
	B	1.9	1.9	1.9	1.9
	C	2.7	2.7	1.9	1.9
	D	4.0	4.0	3.0	2.7

Departure-Departure Separations (seconds)

VFR - Near Term

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	35	35	45	50
	B	30	35	45	50
	C	50	50	60	60
	D	120	120	120	120

19. Route Data: See Figure C-3.

20. Two-Way Path Data:

Two-way taxiways are located as follows:

1. Taxiway V.

21. Common Approach Paths:

Arrival Runway	Aircraft Class	Length of Common Approach Path
8	A	3.0
	B	3.0
	C	5.0
	D	5.0
9R	A	3.0
	B	3.0
	C	5.0
	D	5.0

22. Vectoring Delays:

This input allocates delays among vectoring and holding. Model input values will be used that hold arrival aircraft if delays to arrival aircraft exceed 10 minutes.

23. Departure Runway Queue Control:

Aircraft are assigned departure runways to preclude airspace crossovers, not to balance departure queues.

24. Gate Hold Control:

Aircraft are held at gates when departure queue at runway is 10 or more, except when gate holds would cause gate congestion.

25. Departure Airspace Constraints:

Aircraft are not held at gates due to departure airspace constraints.

26. Inter-Arrival Gap:

With this runway use, arrival aircraft are delayed in the arrival airspace when departure delays exceed 10 minutes.

27. Runway Crossing Delay Control:

Arrival and departure runway operations are only interrupted for a taxiing aircraft to cross an active runway when the taxiing aircraft is delayed by 4 minutes or more.

D. AIRCRAFT OPERATIONAL CHARACTERISTICS

28. Exit Taxiway Utilization:

		Exit Utilization (percent)							
	A/C Class	C	D	E	F	V	G	H	K
Runway 8	A	70	30	0	0	0	0	0	0
	B	60	20	10	0	10	0	0	0
	C	0	4	28	24	36	7	0	0
	D	0	0	0	0	40	60	0	0

	Exit Utilization (percent)			
	A/C Class	X	Y	M
Runway 9R	A	100	0	0
	B	100	0	0
	C	13	83	4
	D	0	100	0

29. Arrival Runway Occupancy Times:

	Runway Occupancy Time (second)							
	A/C Class	C	D	E	F	V	G	H	K
Runway 8	A	40	45	-	-	-	-	-	-
	B	35	40	50	-	-	-	-	-
	C	-	35	45	50	60	-	-	-
	D	-	-	-	-	60	65	-	-

	A/C Class	X	Y	M
Runway 9R	A	45	-	-
	B	50	-	-
	C	40	60	65
	D	-	60	-

30. Touch & Go Occupancy Times:

Aircraft Class	Runway Occupancy Time (seconds)	
	Mean	Standard Deviation
A	22	3
B	23	3
C	27	4
D	27	4

31. Departure Runway Occupancy Times:

Aircraft Class	Runway Occupancy Time (seconds)	
	Mean	Standard Deviation
A	34	3
B	34	3
C	39	4
D	39	4

32. Taxi Speeds: To be based on reduced field data.

33. Approach Speeds:

Aircraft Class	Approach Speed (knots) Mean	Standard Deviation
A	95	10
B	120	10
C	130	10
D	140	10

34. Gate Service Times: To be based on reduced field data.

35. Airspace Travel Times: To be based on reduced field data.

36. Runway Crossing Times: 20 seconds.

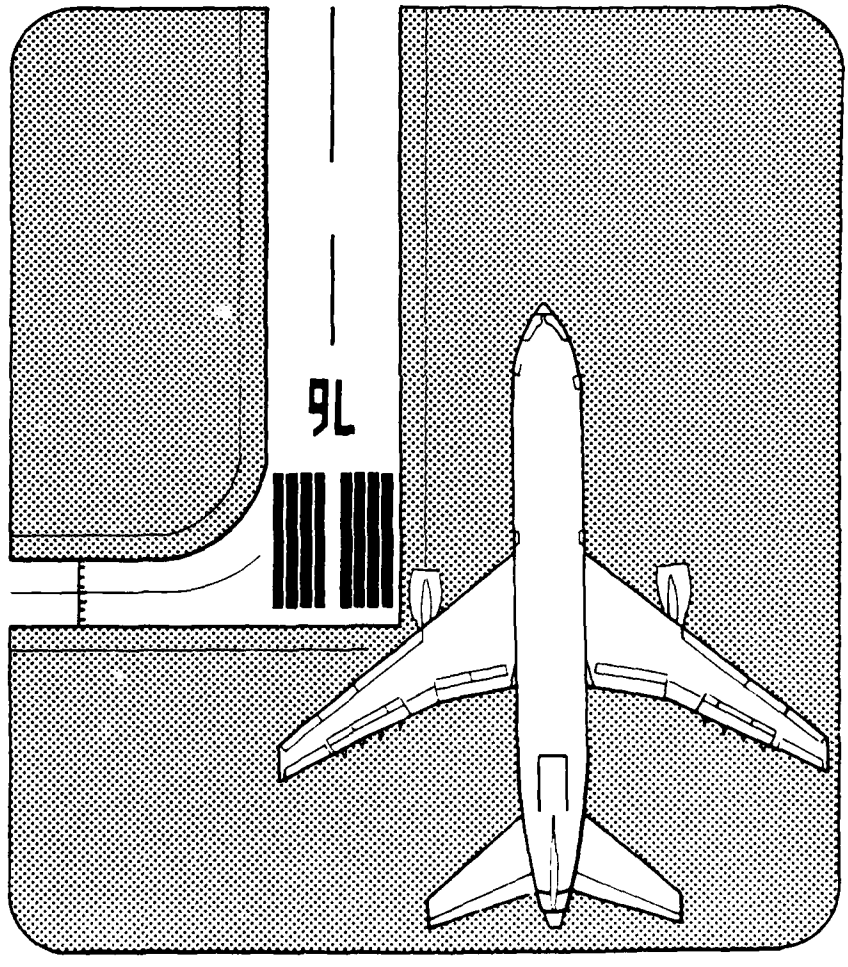
37. Lateness Distribution: See Table 1.

38. Demand: To be based on reduced field data.

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

DATA PACKAGE NO. 3

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES



prepared for

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

under contract

DOT FA77WA -3961

PMM&Co. Peat, Marwick, Mitchell & Co.

SEPTEMBER 1978

PEAT, MARWICK, MITCHELL & CO.
P. O. BOX 8007
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN FRANCISCO, CALIFORNIA 94128

Telephone: (415) 347-9521

September 13, 1978

Mr. Ray Fowler, AEM-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Re: Atlanta Data Package No. 3

Dear Ray:

Enclosed is data package No. 3 for William B. Hartsfield Atlanta International Airport. The package contains the results of the Stage 1 delay experiments (Attachment A) ad an input data package for Stage 2 experiments (Attachment B).

These data should be reviewed by the Atlanta Task Force during the 15th September 1978 Task Force meeting.

Sincerely,

Stephen L. M. Hockaday
Manager

SLMH/sq
Enclosure

cc: Mr. J. R. Dupree (ALG-312)
Mr. B. Drotts (ASO-4) (w/encl)

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES
Atlanta International Airport
Data Package No. 3

Table of Contents

Attachment A

RESULTS OF STAGE 1 DELAY EXPERIMENTS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

September 1978

Table A-1

ATLANTA TASK FORCE DELAY STUDIES
LIST OF STAGE 1 EXPERIMENTS
AND
INDEX TO RESULTS

Experiment No.	Model	Runways		Weather	Demand/ Improvement ATC	Page
		Arrivals	Departures			
1A	ASM	8, 9R	8, 9L	VFR1	1978	4
2A	ASM	8, 9R	8, 9L	IFR1	1978	7
1	ASM	8, 9R	8, 9L	VFR1	1982	11
2	ASM	8, 9R	8, 9L	IFR1	1982	14
3	ASM	9R	8, 9L	IFR2	1982	19
5	ASM	8, 9R	8, 9L	IFR1	1982-2 n.m. stagger	22
6	ASM	8, 9R	8, 9L	IFR1	1982-1.5 n.m. stagger	26
12	ADM	n.a.	n.a.	n.a.	1978	30

Table A-2

ATLANTA TASK FORCE DELAY STUDIES
SUMMARY RESULTS OF STAGE 1 EXPERIMENTS
AIRFIELD SIMULATION MODEL RUNS

Experiment No.	Runways Used		Time Frame	Weather Conditions	Average Flow Rates				Average Runway Delays				Average Airfield Delays						Comparison Case
					Arrivals		Departures		Arrival Air		Departures		Taxi-In		Gate		Taxi-Out		
	Arrivals	Departures			Peak	Time	Peak	Time	Peak	Time	Peak	Time	Peak	Time	Peak	Time	Peak	Time	
1A	8, 9R	8, 9L	1978	VFR1	70	11-12	59		11.6		11.6		0.3				0.3		Baseline
2A	8, 9R	8, 9L	1978	IFR1	14	12:30-12:45	17		42.9		15.5		0.3				0.4		Baseline
1	8, 9R	8, 9L	1982	VFR1	74	11-12	60		11.2		12.0		0.3				0.2		1A
2	8, 9R	8, 9L	1982	IFR1	16	12:30-12:45	15		61.7	20:45-21:00	35.4	19:15 19:30	0.2				0.2		2A
3	9R	8, 9L	1982	IFR2	34	11-11	53	10-11	260.3	19-20	7.1	19-20	0.1				4.8		2
5	8, 9R	8, 9L	1982	IFR1	10	12:30-12:45	6		87.2		0.9		0.1				0.1		2
6	8, 9R	8, 9L	1982	IFR1	13	12:30-12:45	10		64.7		4.8		0.2				0.1		2

EXPERIMENT NO. 1A

Objective:

To obtain 1978 baseline delay estimates in VFR1 weather for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment 2A has same demand and network but in IFR1 weather.

Length and Level of Detail of Simulation Run:

From 8:00 to 22:00 (14 hours) with 1-hour output summaries.

Results:

Figure (1A) A shows that the total aircraft flow rates vary from 33 to 129 aircraft per hour over the 13-hour run. The peak hour is from 11:00 to 12:00 hours and contains 70 arrival aircraft and 59 departure aircraft.

Figure (1A) B shows the pattern of average delays to aircraft and that the peak-hour average delay to arrivals was 14.2 minutes while the peak-hour average delay to departures was 12.1 minutes.

Figure (1A) C shows the pattern of average delays to aircraft using the taxiways, i.e., taxi-in delay and taxi-out delays, which had peak-hour average values of 0.5 minutes and 0.6 minutes, respectively.

FIGURE (1A)A--AVERAGE RUNWAY FLOW RATES

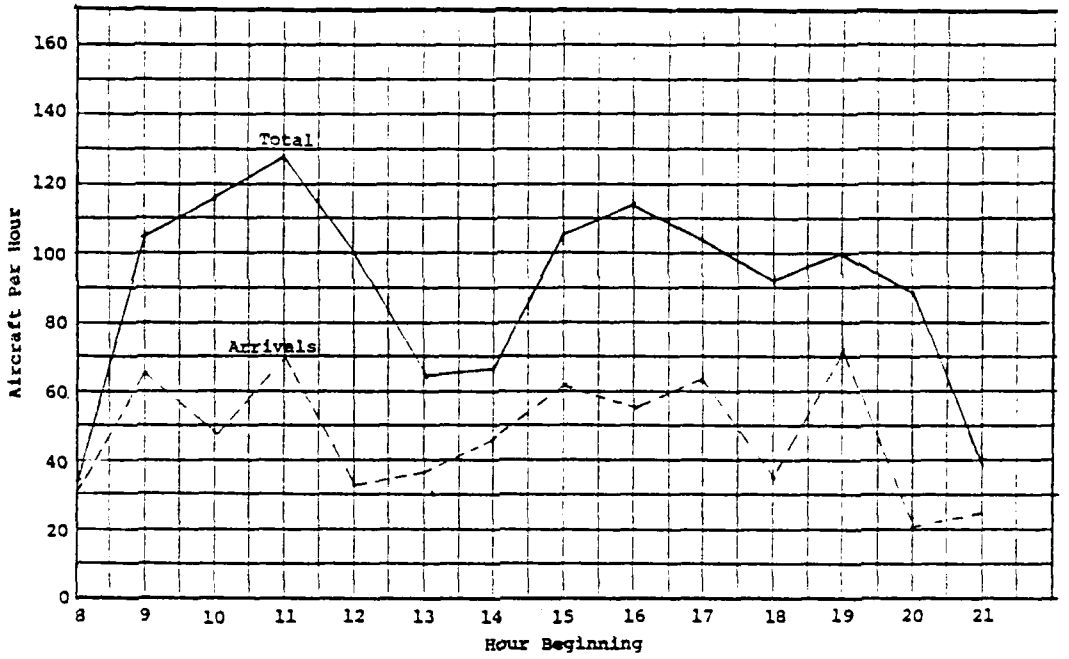


FIGURE (1A)B--AVERAGE RUNWAY DELAYS

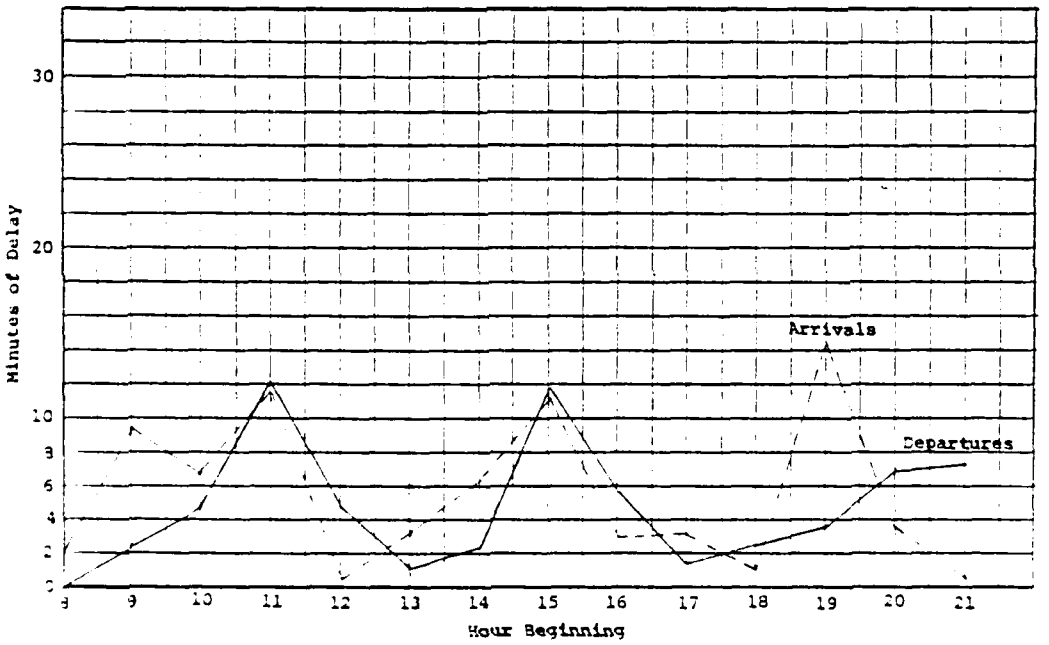


FIGURE (1A)C--AVERAGE TAXIWAY DELAYS

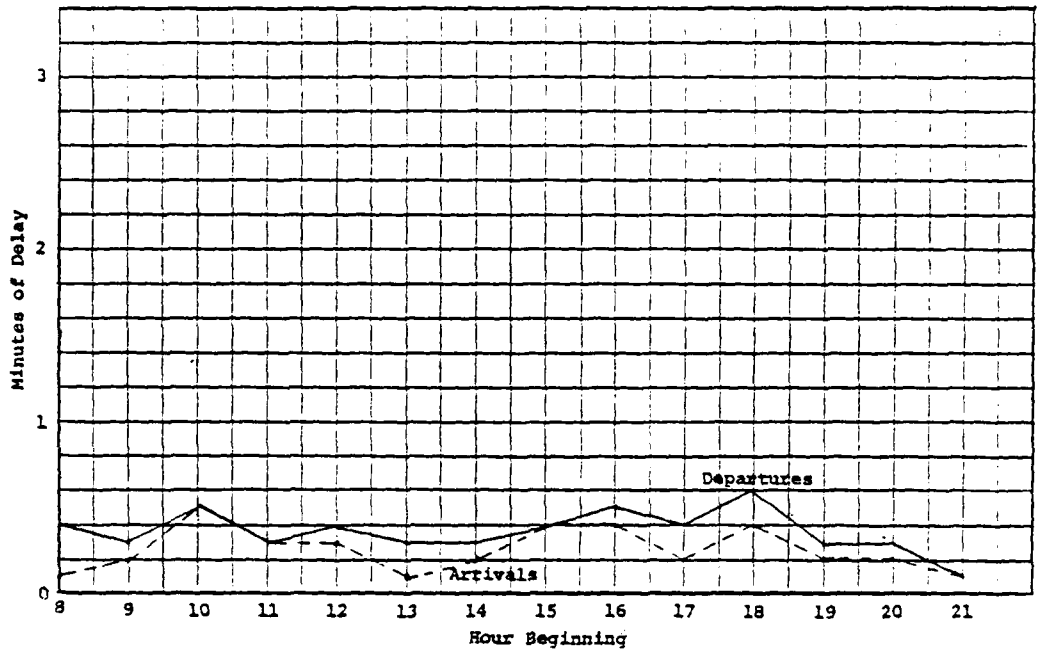
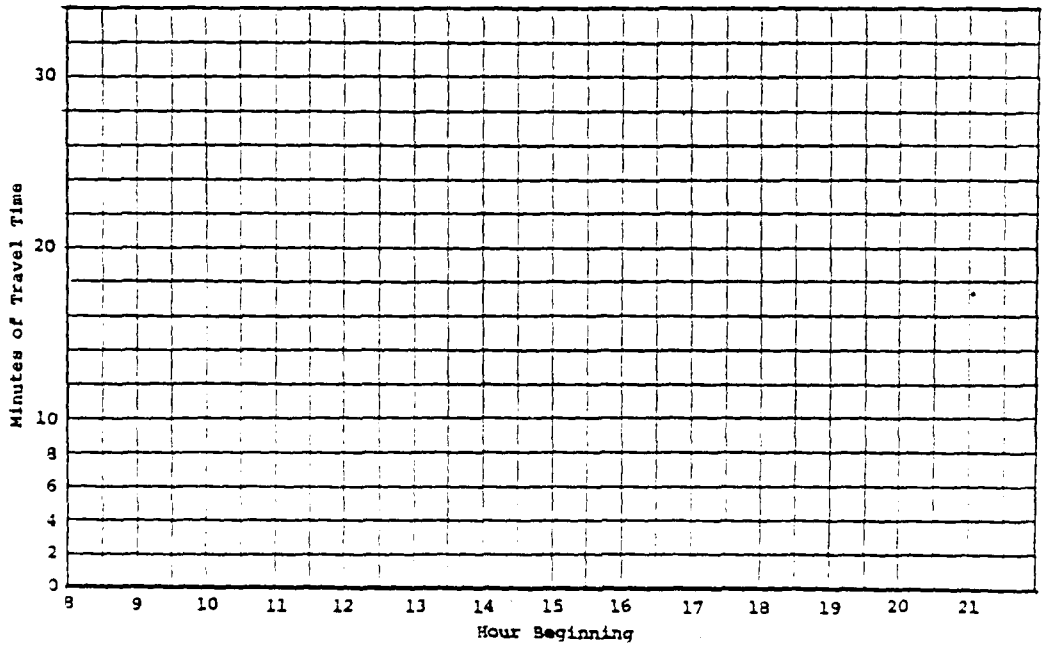


FIGURE D--AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 2A

Objective:

To obtain 1978 baseline delay estimates in IFR1 weather for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment 1A has same demand and network but in VFR1 weather.

Length and Level of Detail of Simulation Run:

From 8:00 to 22:00 (14 hours) with 15-minute summaries.

Results:

Figure (2A) A shows that total aircraft flows vary from 32 to 113 aircraft per hour over the 13-hour simulation run. The peak hour is from 12:00 to 13:00 hours and contained 53 arrivals and 60 departures.

Figure (2A) B shows that average delays to aircraft using the runways are as high as 33.0 minutes per aircraft. Peak hour average delays are 33.0 minutes for arrivals and 25.8 minutes for departures.

Figure (2A) C shows that the peak-period average delays to aircraft using the taxiways are 1.3 minutes for taxi-in and 1.1 minutes for taxi-out.

Figures (2A) E and (2A) F show variation of runway flow rates and delays by 15-minute period. Note that the peak 15-minute total flow rate is 31 aircraft per hour, which is 27 percent of the corresponding peak-hour total flow rate. The peak 15-minute average delays are 42.9 minutes for arrvials and 34.2 minutes for departures.

FIGURE (2A)A--AVERAGE RUNWAY FLOW RATES

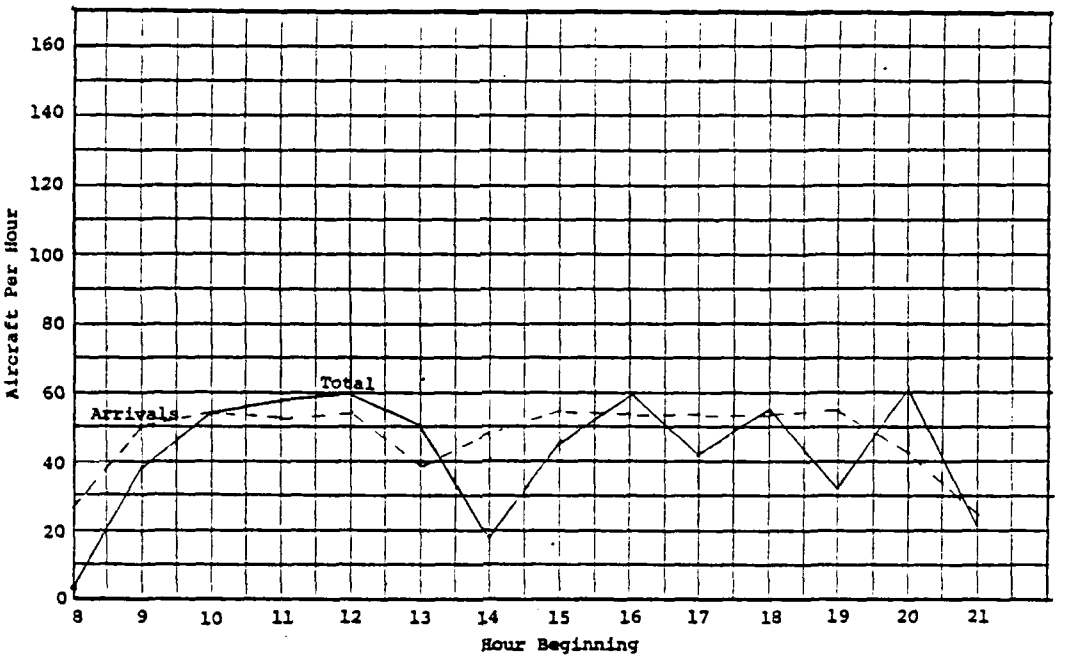


FIGURE (2A)B--AVERAGE RUNWAY DELAYS

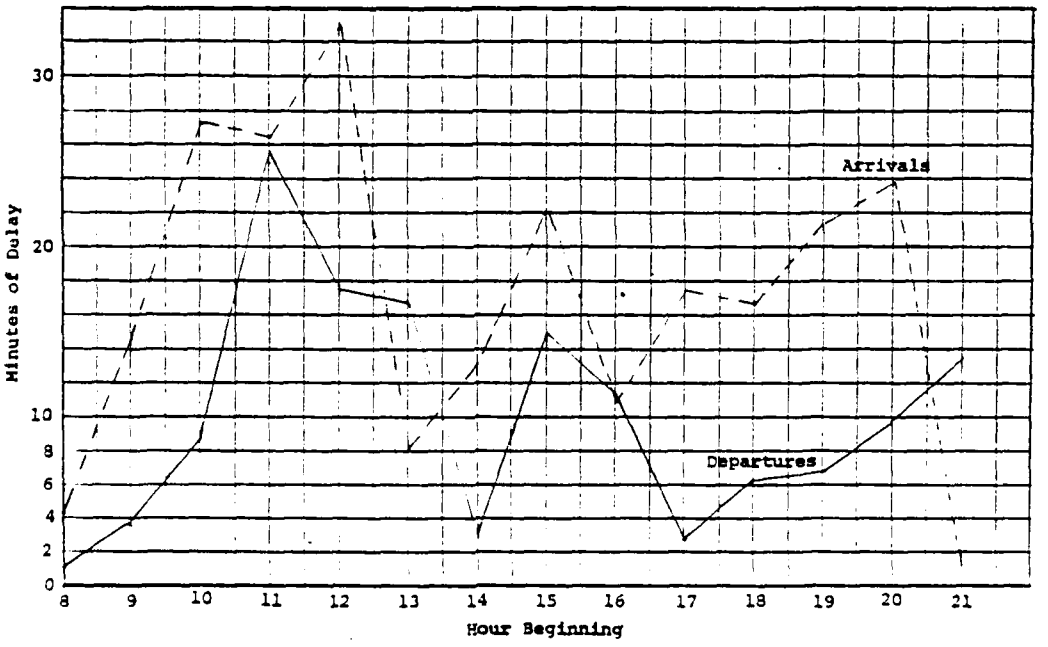


FIGURE (2A)C--AVERAGE TAXIWAY DELAYS

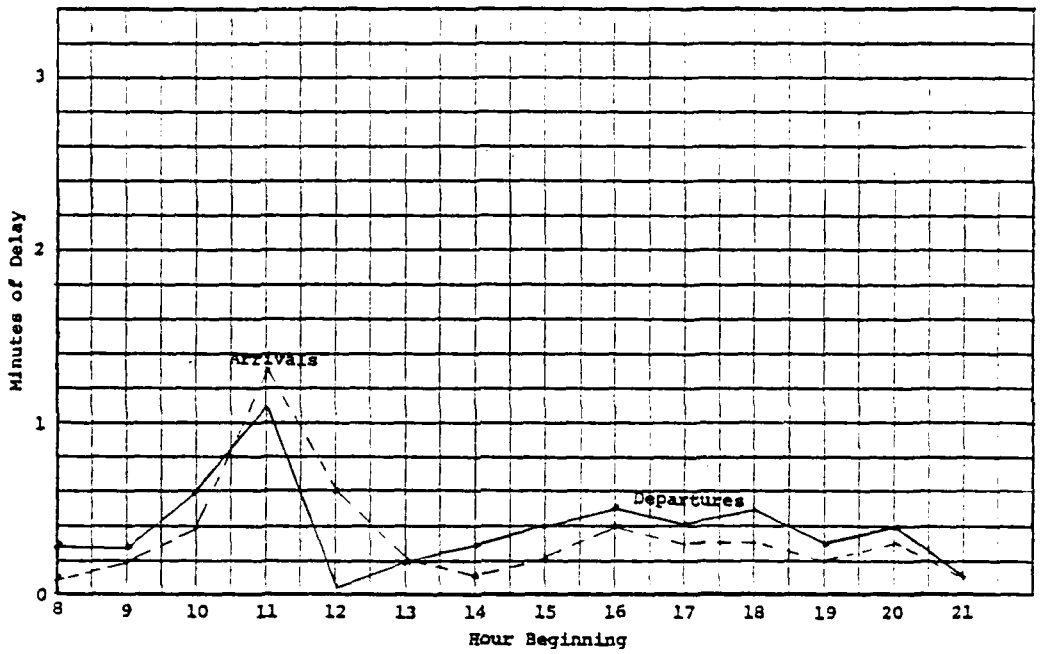


FIGURE D--AVERAGE TAXIWAY TRAVEL TIMES

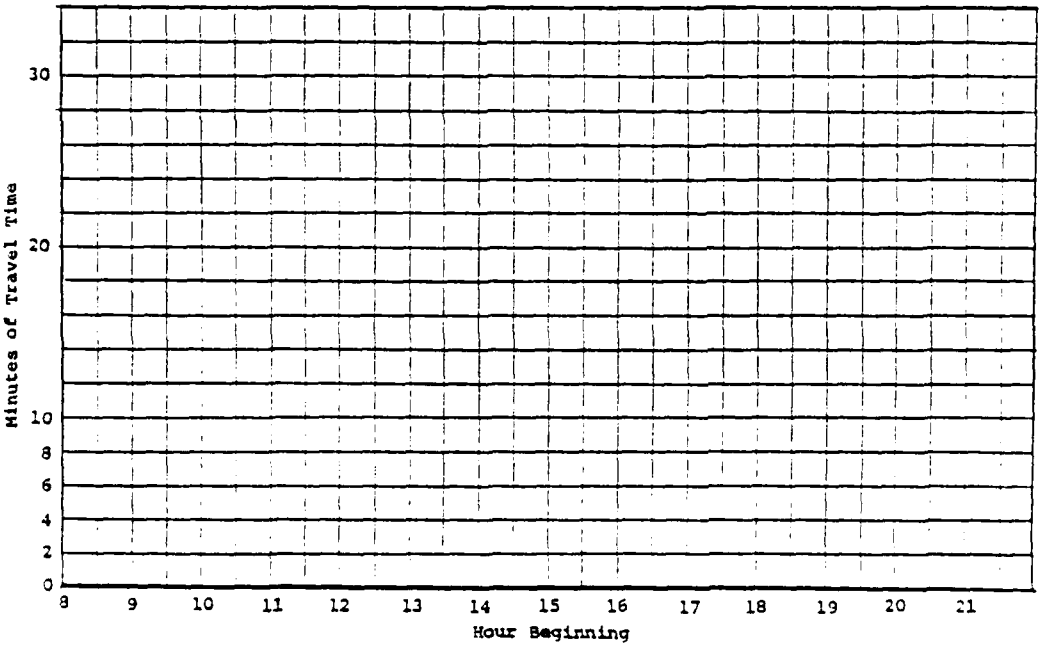


FIGURE (2A)E—AVERAGE RUNWAY FLOW RATES

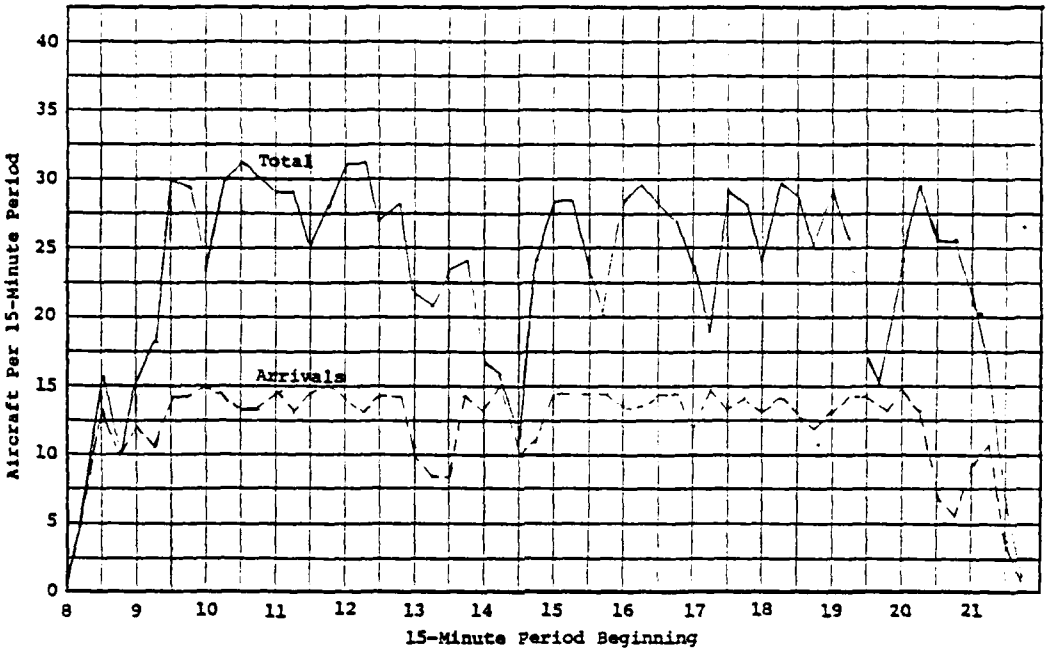
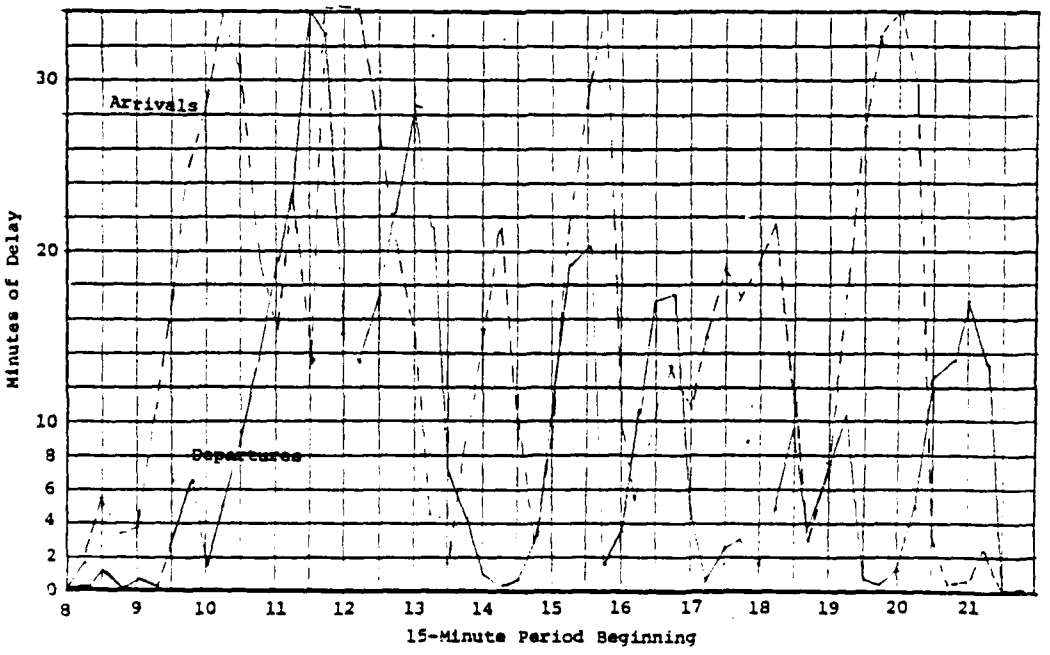


FIGURE (2A)F—AVERAGE RUNWAY DELAYS



EXPERIMENT NO. 1

Objective:

To obtain delay estimates in VFR1 weather with the new Midfield Terminal, 1982 demand, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be viewed in comparison with Experiment No. 1A which was for the old terminal and 1978 demand and ATC separations in VFR1 weather.

Length and Level of Detail of Simulation Run:

From 8:00 to 22:00 with 1-hour output summaries.

Results:

Figure (1A) A shows that the total aircraft flow rates vary from 33 to 136 aircraft per hour over the 13-hour run. The peak hour is from 19:00 to 20:00 hours and contains 77 arrival aircraft and 59 departure aircraft.

Figure (1A) B shows the pattern of average delays to aircraft and that the peak-hour average delay to arrivals was 11.6 minutes while the peak-hour average delay to departures was 12.0 minutes.

Figure (1A) C shows the pattern of average delays to aircraft using the taxiways, i.e., taxi-in delay and taxi-out delays, which had peak-hour average values of 0.3 minutes and 1.9 minutes, respectively.

FIGURE 1A--AVERAGE RUNWAY FLOW RATES

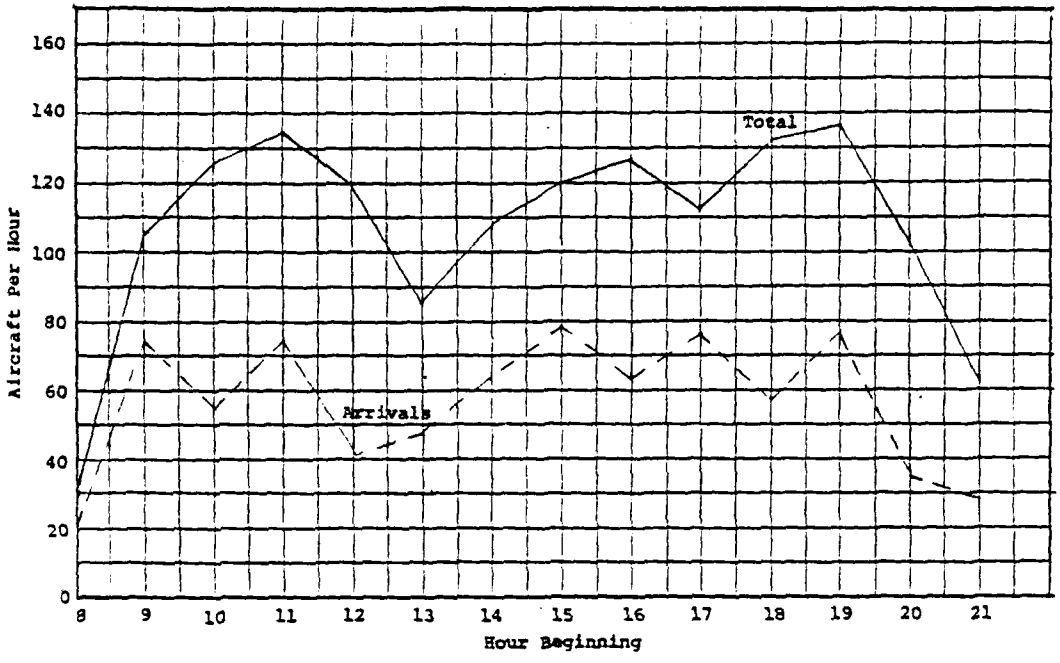


FIGURE 1B--AVERAGE RUNWAY DELAYS

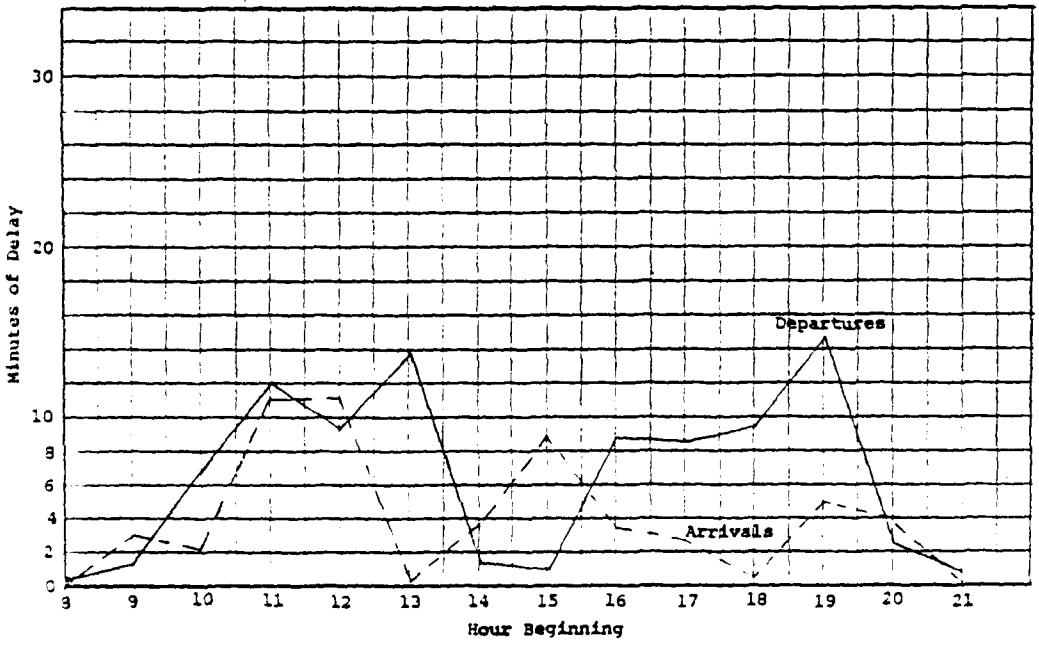


FIGURE 1C--AVERAGE TAXIWAY DELAYS

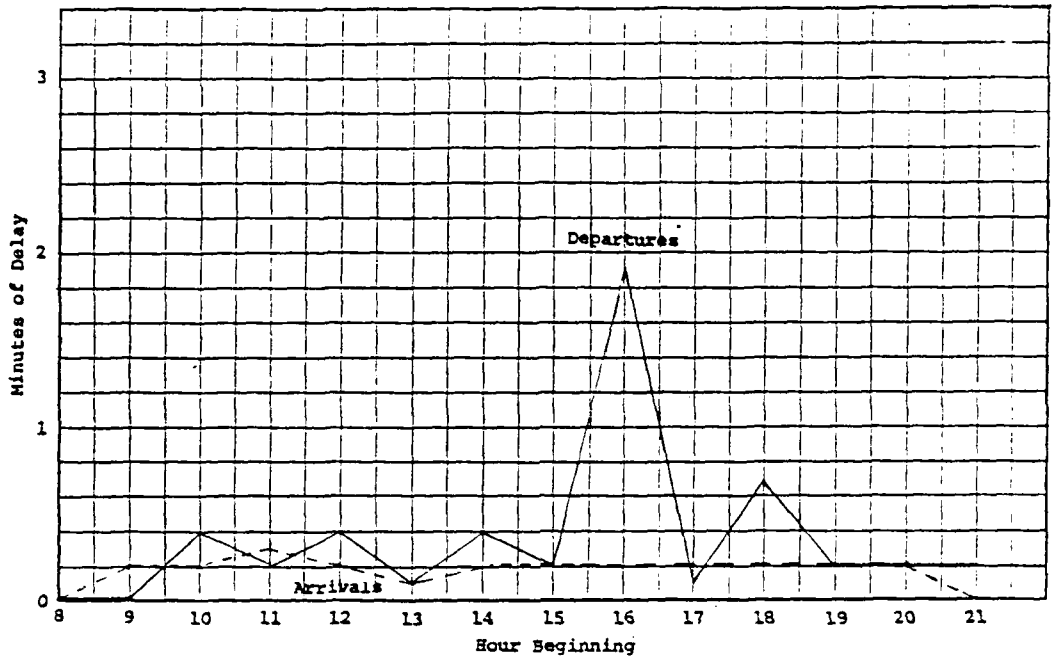
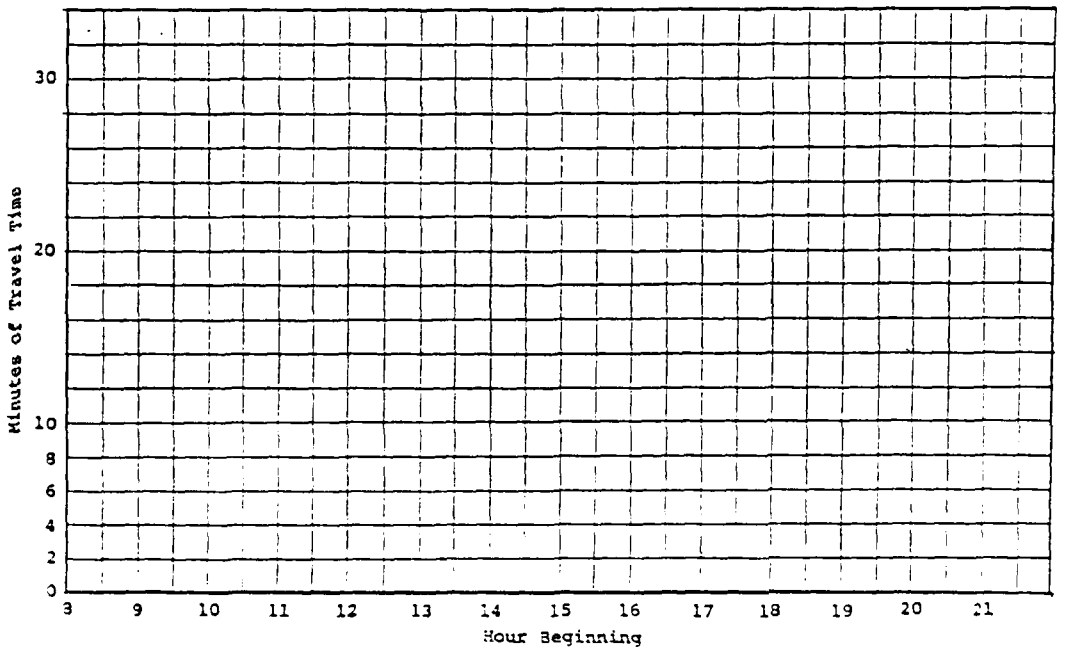


FIGURE 1D--AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 2

Objective:

To obtain delay estimates in IFR1 weather with the Midfield Terminal, 1982 demand, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared to Experiment No. 2A to examine differences due to the new demand, ATC separations, and terminal building compared to today's IRF1 conditions. It can also be compared to Experiment No. 1 to examine differences between 1982 VFR1 and IFR1.

Length and Level of Detail of Simulation Run:

From 8:00 to 22:00 with 15-minute output summaries.

Results:

Figure (2A) A shows that total aircraft flows vary from 32 to 128 aircraft per hour over the 13-hour simulation run. The peak hour is from 11:00 to 12:00 hours and contained 60 arrivals and 68 departures.

Figure (2A) B shows that average delays to aircraft using the runways are as high as 38.3 minutes per aircraft. Peak hour average delays are 38.3 minutes for arrivals and 37.8 minutes for departures.

Figure (2A) C shows that the peak-period average delays to aircraft using the taxiways are 0.2 minutes for taxi-in and 1.3 minutes for taxi-out.

Figures (2A) E and (2A) F show variation of runway flow rates and delays by 15-minute period. Note that the peak 15-minute total flow rate is 31 aircraft per hour, which is 27 percent of the corresponding peak-hour total flow rate. The peak 15-minute average delays are 61.7 minutes for arrvials and 35.4 minutes for departures.

FIGURE 2A--AVERAGE RUNWAY FLOW RATES

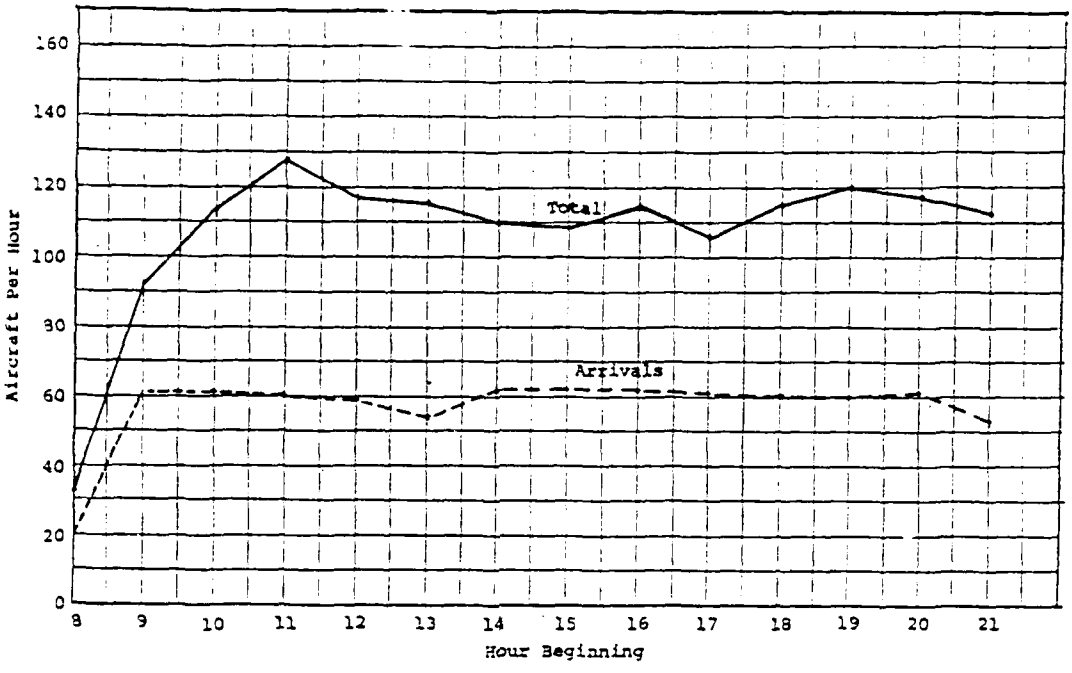


FIGURE 2B--AVERAGE RUNWAY DELAYS

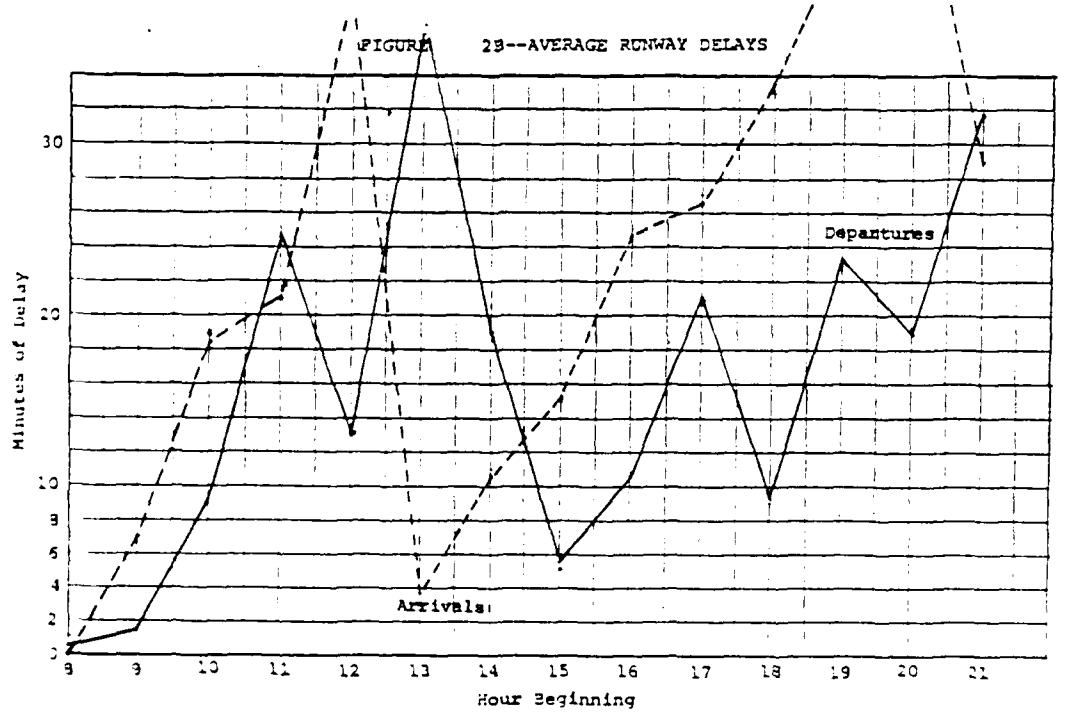


FIGURE 2C—AVERAGE TAXIWAY DELAYS

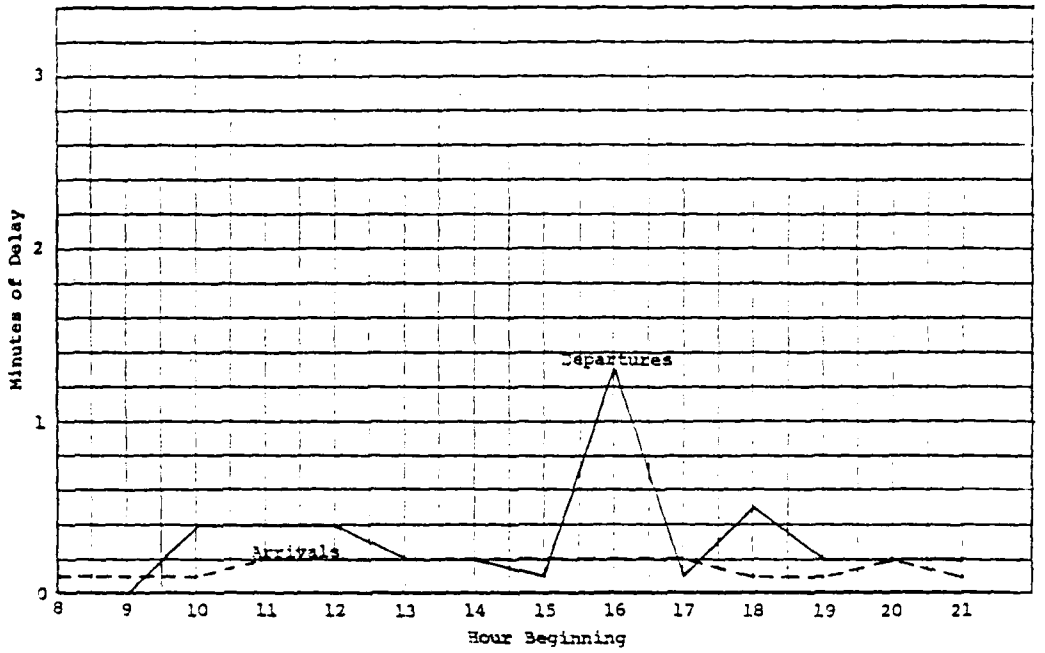


FIGURE D--AVERAGE TAXIWAY TRAVEL TIMES

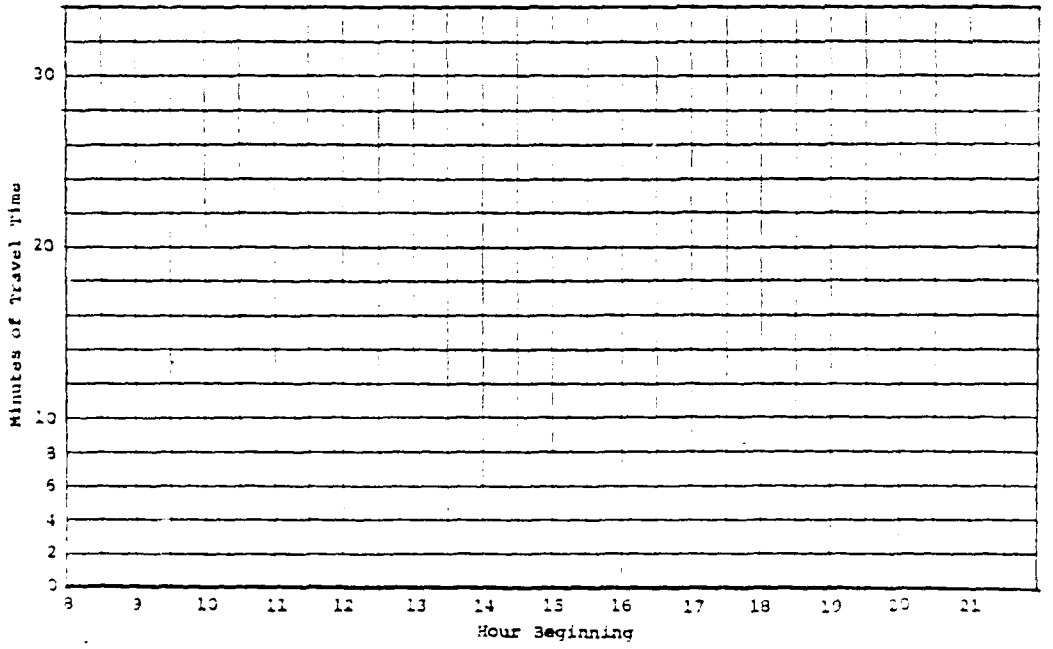


FIGURE 2E—AVERAGE RUNWAY FLOW RATES

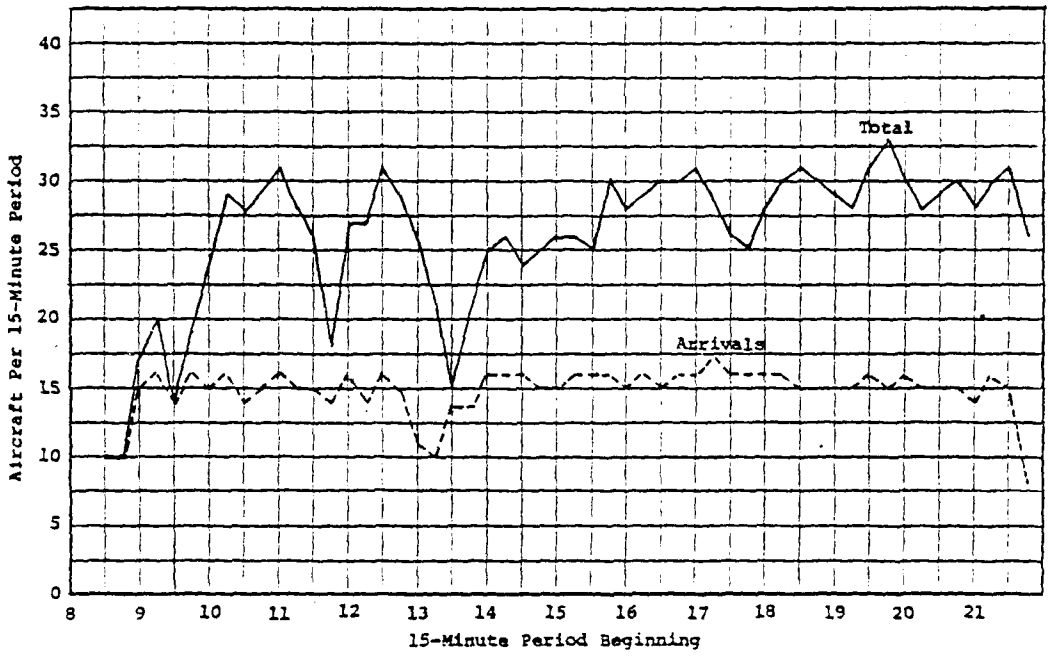
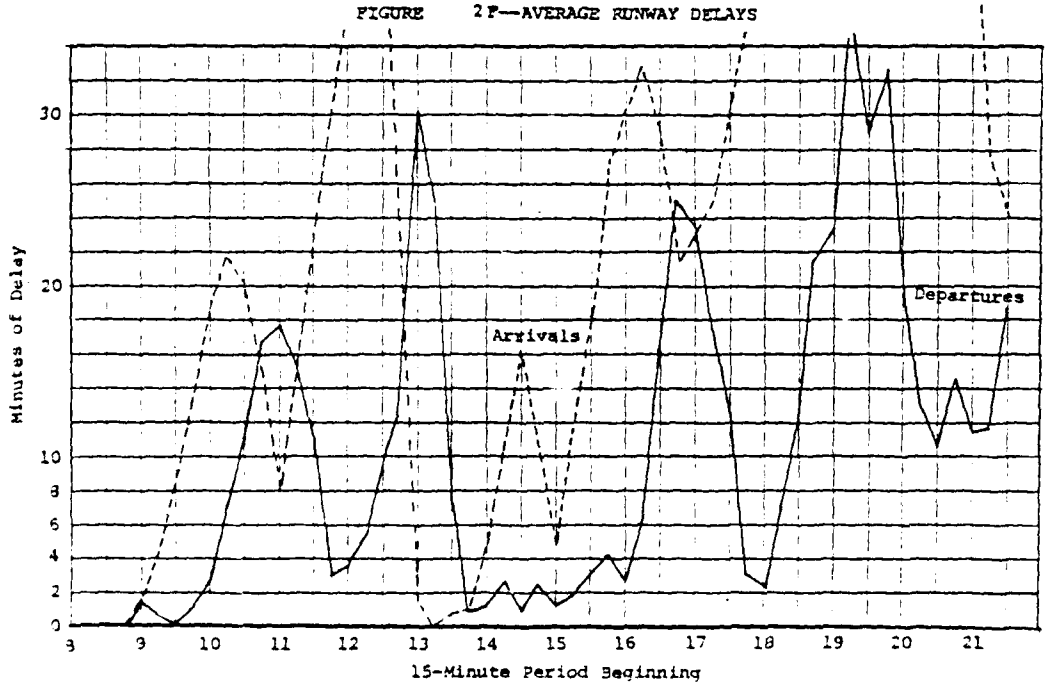


FIGURE 2F—AVERAGE RUNWAY DELAYS



EXPERIMENT NO. 3

Objective:

To obtain delay estimates in IFR2 weather with the 1982 demand, Midfield Terminal, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared to the results of Experiment No. 2 to examine differences between 1982 IFR1 and IFR2.

Length and Level of Detail of Simulation Run:

From 8:00 to 22:00 with 1-hour output summaries.

Results:

Figure (1A) A shows that the total aircraft flow rates vary from 27 to 84 aircraft per hour over the 13-hour run. The peak hour is from 10:00 to 11:00 hours and contains 31 arrival aircraft and 53 departure aircraft.

Figure (1A) B shows the pattern of average delays to aircraft and that the peak-hour average delay to arrivals was 260.3 minutes while the peak-hour average delay to departures was 7.1 minutes.

Figure (1A) C shows the pattern of average delays to aircraft using the taxiways, i.e., taxi-in delay and taxi-out delays, which had peak-hour average values of 0.1 minutes and 4.8 minutes, respectively.

The foregoing very high arrival delays are due to an extended period during which there is an excess of demand over capacity. In practice, IFR2 weather rarely occurs for 14 hours straight. In any event, delays of 260 minutes are unrealistic as cancellations and diversions would occur long before delays became that great.

FIGURE 3 A--AVERAGE RUNWAY FLOW RATES

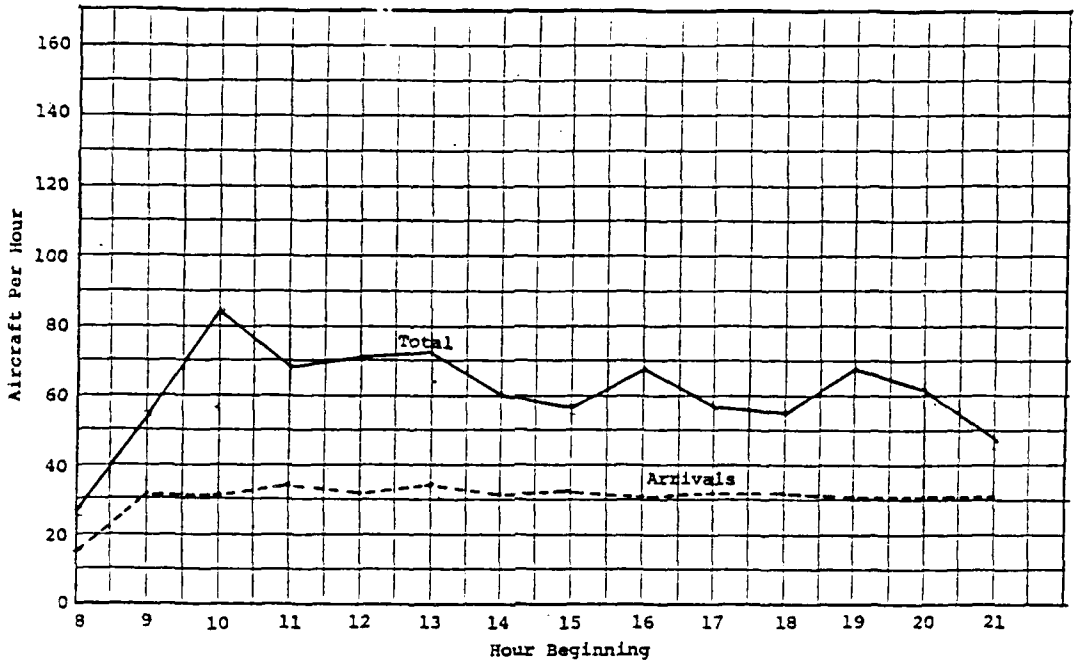


FIGURE 3 B--AVERAGE RUNWAY DELAYS

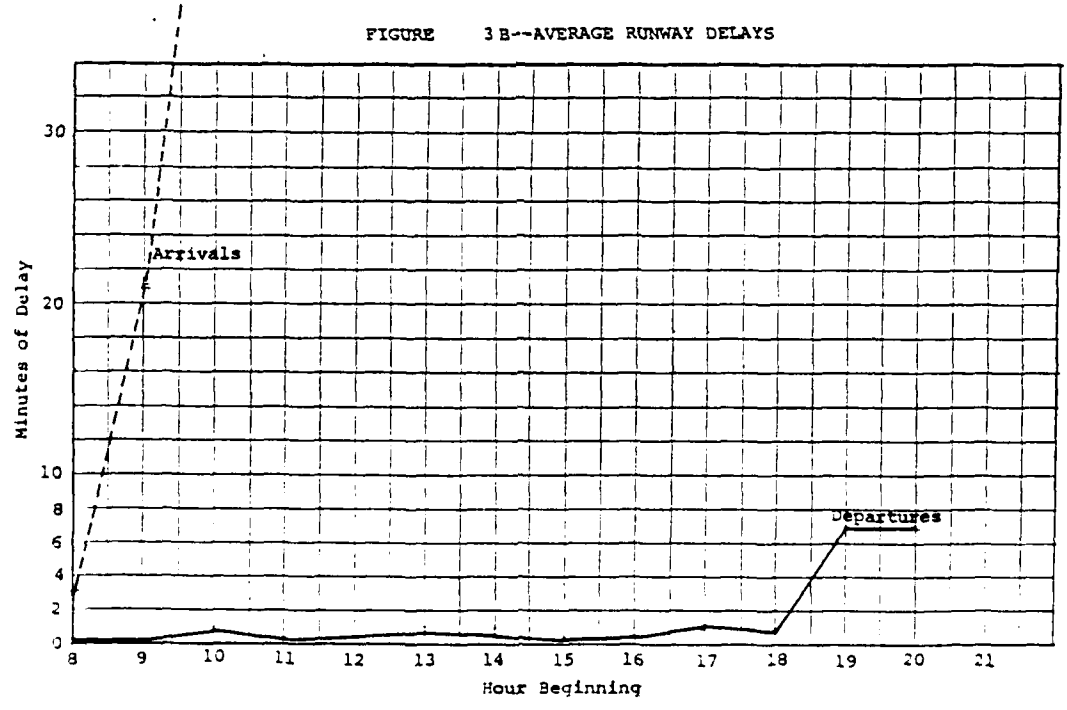


FIGURE 3C--AVERAGE TAXIWAY DELAYS

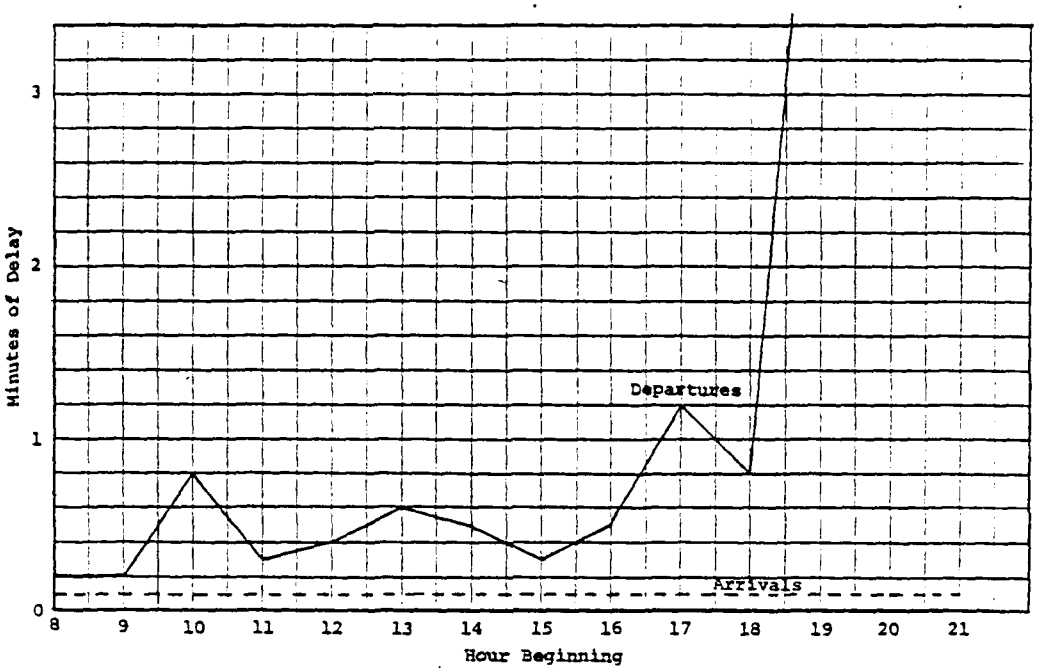
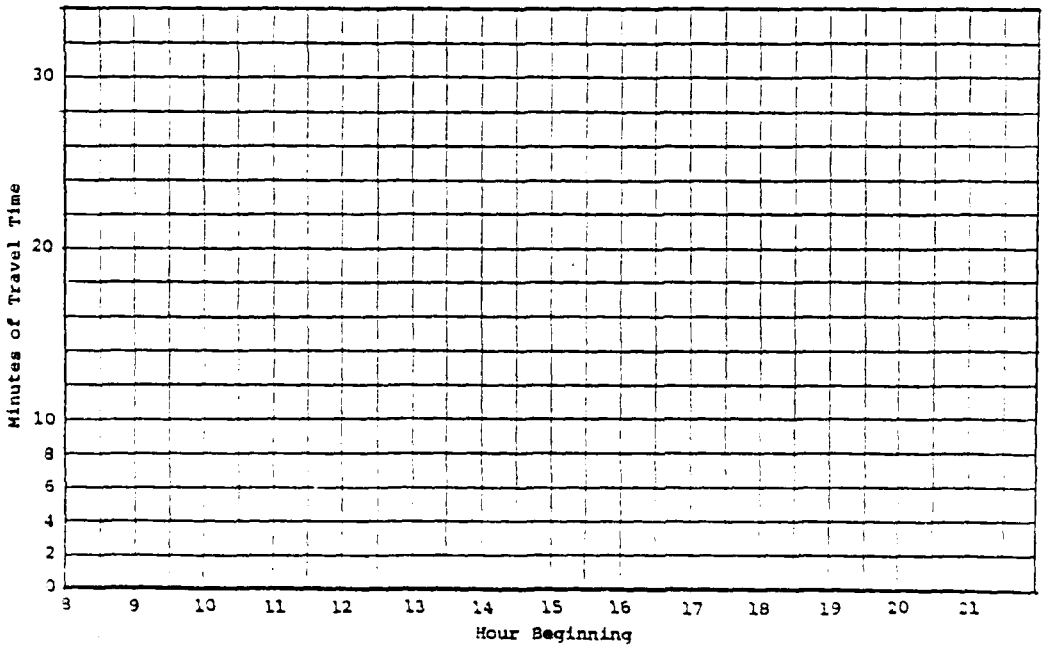


FIGURE 3D—AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 5

Objective:

To obtain delay estimates in IFR1 weather associated with 2.0 nautical mile staggered arrival-arrival separations proposed for use when simultaneous, independent arrivals cannot be accommodated on the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment, in particular arrival flow rates and delays, can be compared with the results of Experiment No. 2.

Length and Level of Detail of Simulation Run:

From 8:00 to 13:00 with 15-minute output summaries.

Results:

Figure 5E shows the pattern, by 15-minute time interval, of the average flow rates. The peak 15-minute, average flow rate occur in the interval 10:45 to 11:00 which contains a total of 25 aircraft of which 12 are arrivals. This compares to the Experiment No. 2 peak flow of 31 aircraft of which 16 are arrivals.

Figure 5F shows the pattern of average runway delays by 15-minute period. The peak average arrival delay on that figure is 87.2 minutes per aircraft and occurs in the interval 12:30 to 12:45. The corresponding peak average arrival delay for simultaneous operations on 8 and 9R (from Experiment No. 2) is 61.7 minutes per aircraft. The comparison for departure delays is a peak average delay of 12.3 minutes for this experiment versus 35.4 minutes from Experiment No. 2.

Figures 5C shows average taxiway delays for this experiment, by 15-minute interval, for the 5-hour period simulated.

FIGURE 5C--AVERAGE TAXIWAY DELAYS

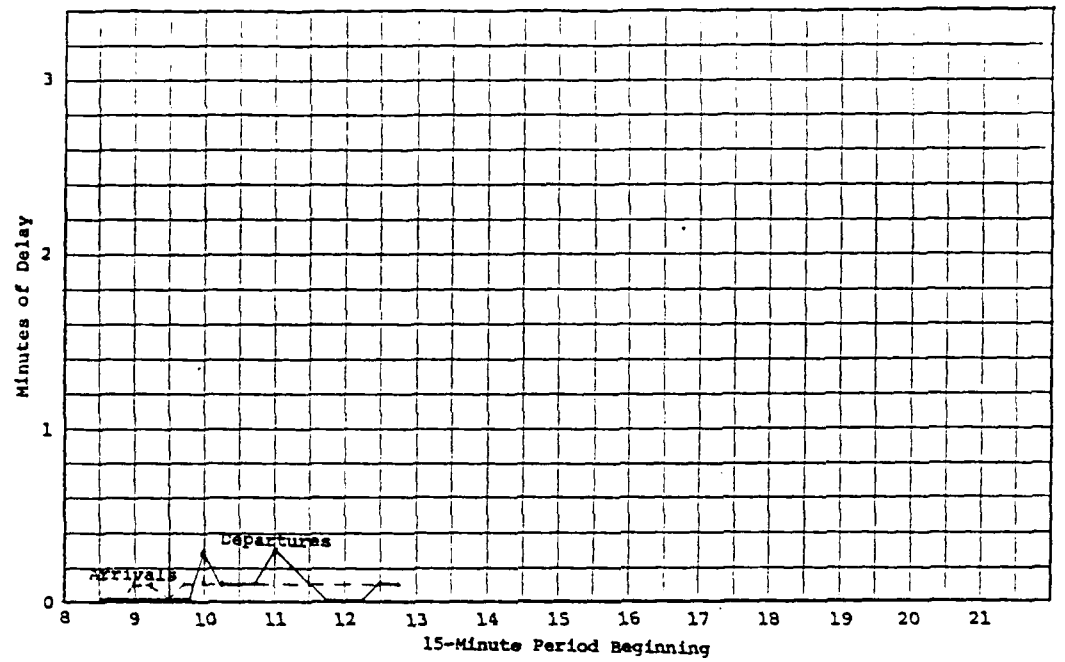


FIGURE 5D--AVERAGE TAXIWAY TRAVEL TIMES

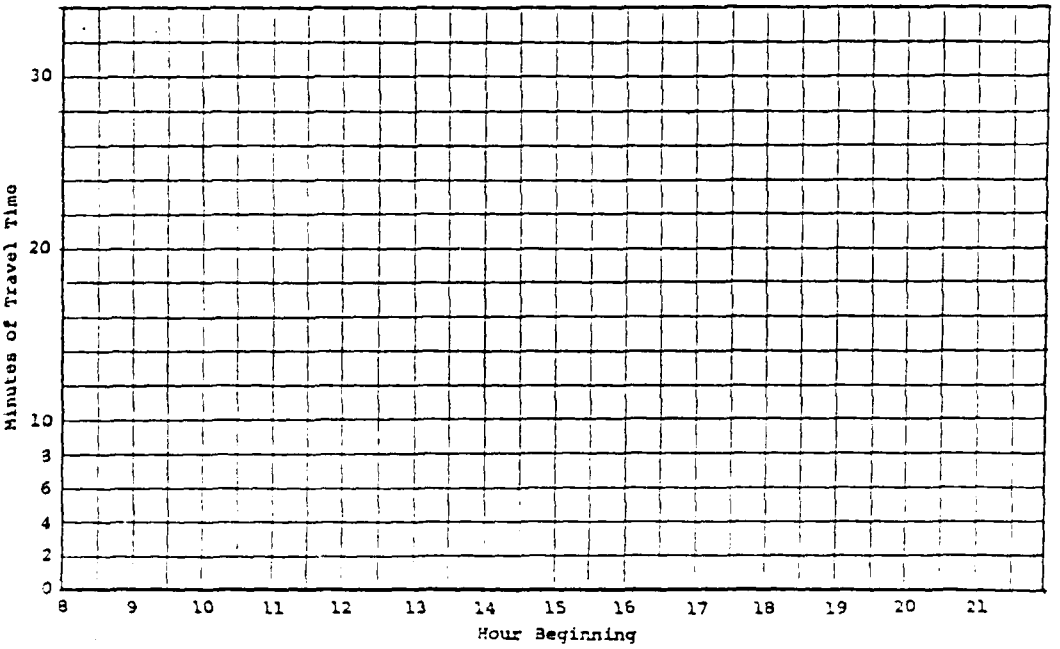


FIGURE 5E--AVERAGE RUNWAY FLOW RATES

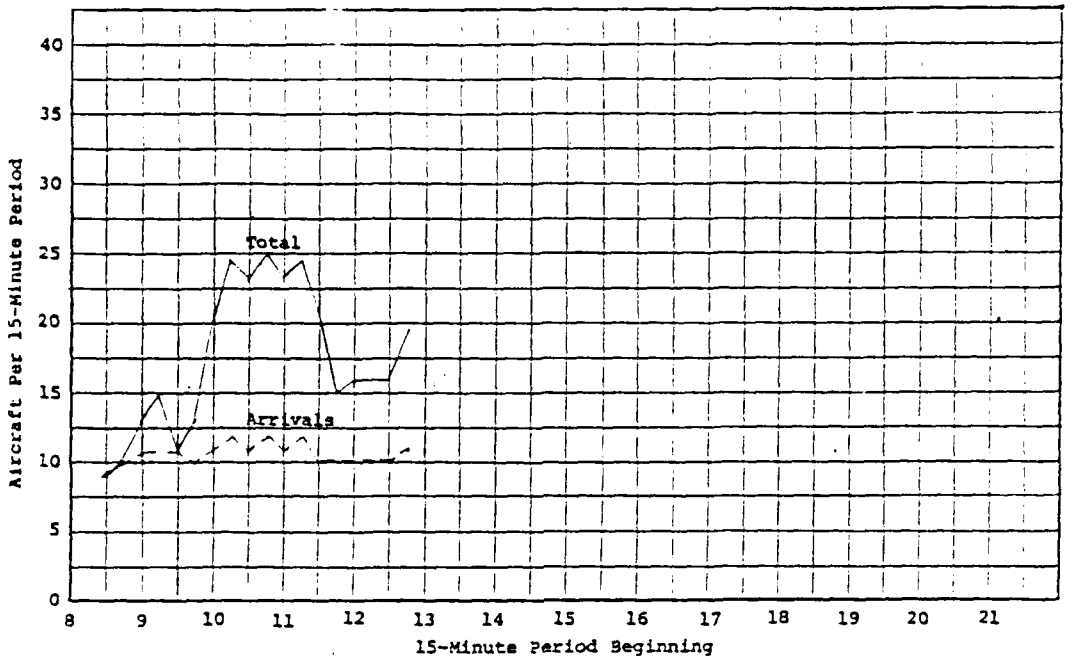
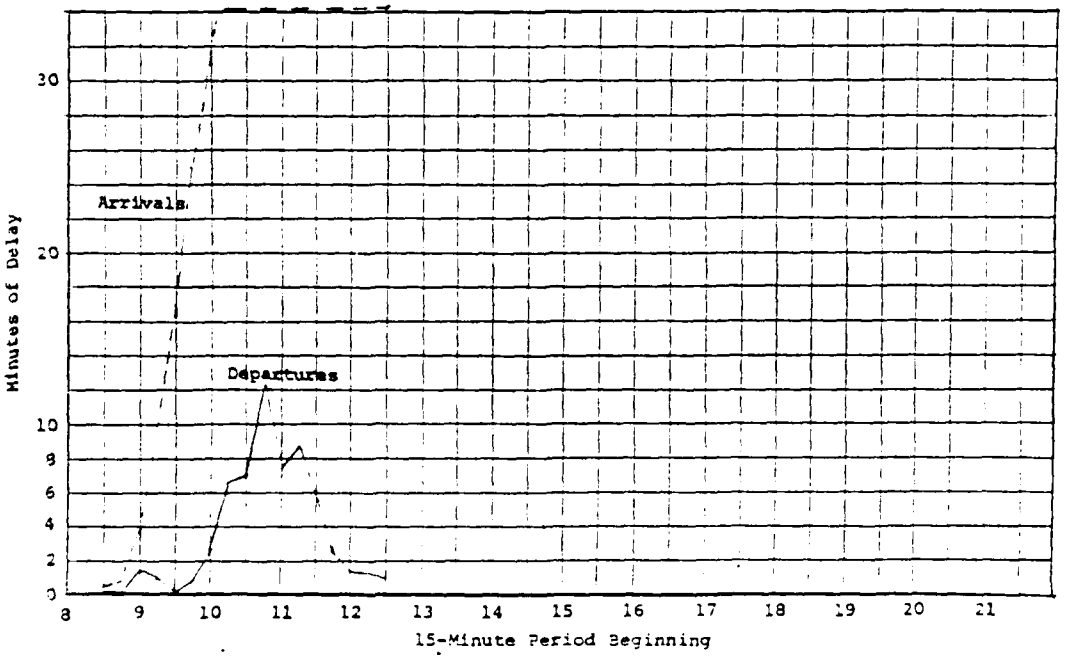


FIGURE 5F--AVERAGE RUNWAY DELAYS



EXPERIMENT NO. 6

Objective:

To obtain delay estimates in IFR1 weather associated with 1.5 nautical mile staggered arrival-arrival separations proposed for use when simultaneous, independent arrivals cannot be accommodated on the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment, in particular arrival flow rates and delays, can be compared with the results of Experiment No. 2.

Length and Level of Detail of Simulation Run:

From 8:00 to 13:00 with 15-minute output summaries.

Results:

Figure 6E shows the pattern, by 15-minute time interval, of the average flow rates. The peak 15-minute, average flow rate occur in the interval 10:30 to 18:45 which contains a total of 27 aircraft of which 13 are arrivals. This compares to the Experiment No. 2 peak flow of 31 aircraft of which 16 are arrivals.

Figure 6F shows the pattern of average runway delays by 15-minute period. The peak average arrival delay on that figure is 64.7 minutes per aircraft and occurs in the interval 12:30 to 12:45. The corresponding peak average arrival delay for simultaneous operations on 8 and 9R (from Experiment No. 2) is 61.7 minutes per aircraft. The comparison for departure delays is a peak average delay of 22.0 minutes for this experiment versus 35.4 minutes from Experiment No. 2.

Figures 6C shows average taxiway delays for this experiment, by 15-minute interval, for the 5-hour period simulated.

FIGURE 6E--AVERAGE RUNWAY FLOW RATES

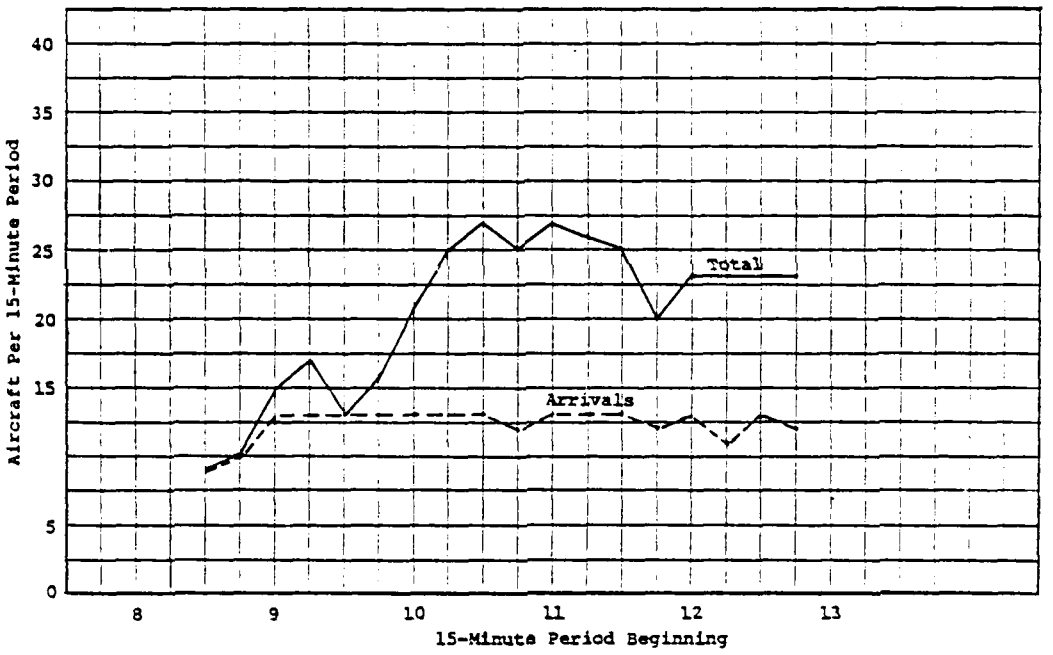


FIGURE 6F--AVERAGE RUNWAY DELAYS

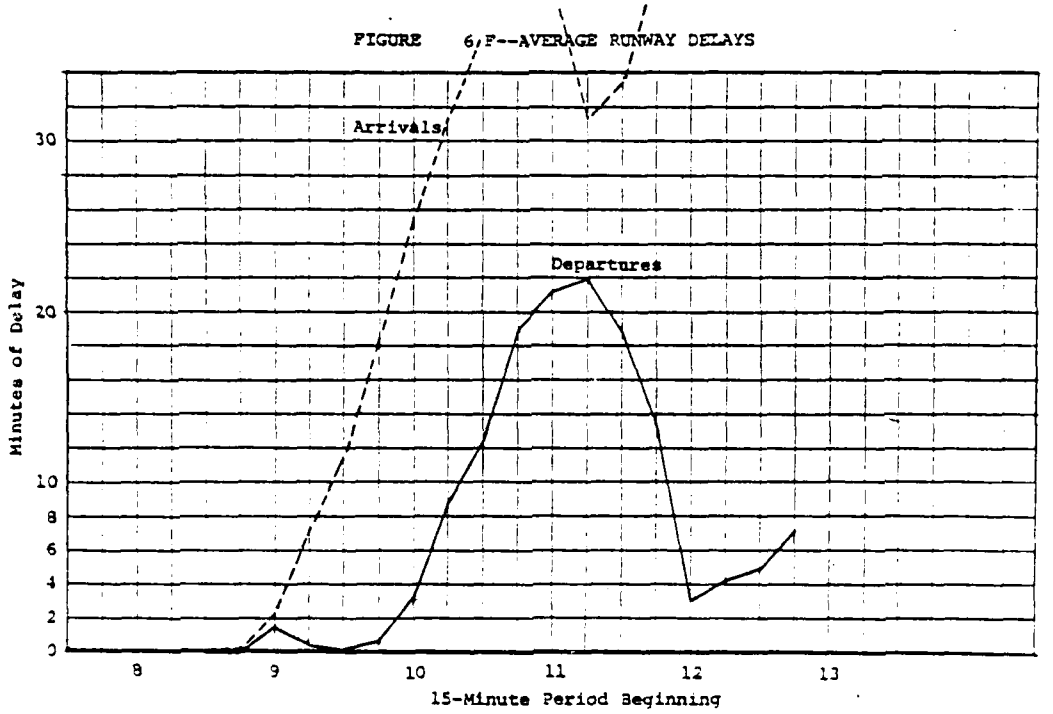


FIGURE 6 C--AVERAGE TAXIWAY DELAYS

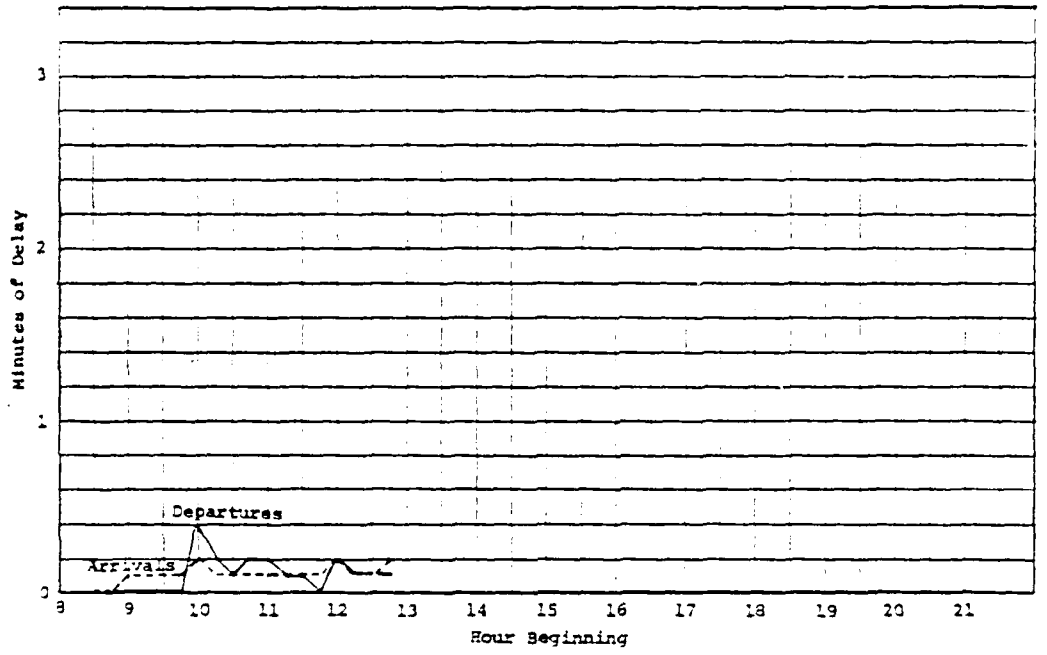
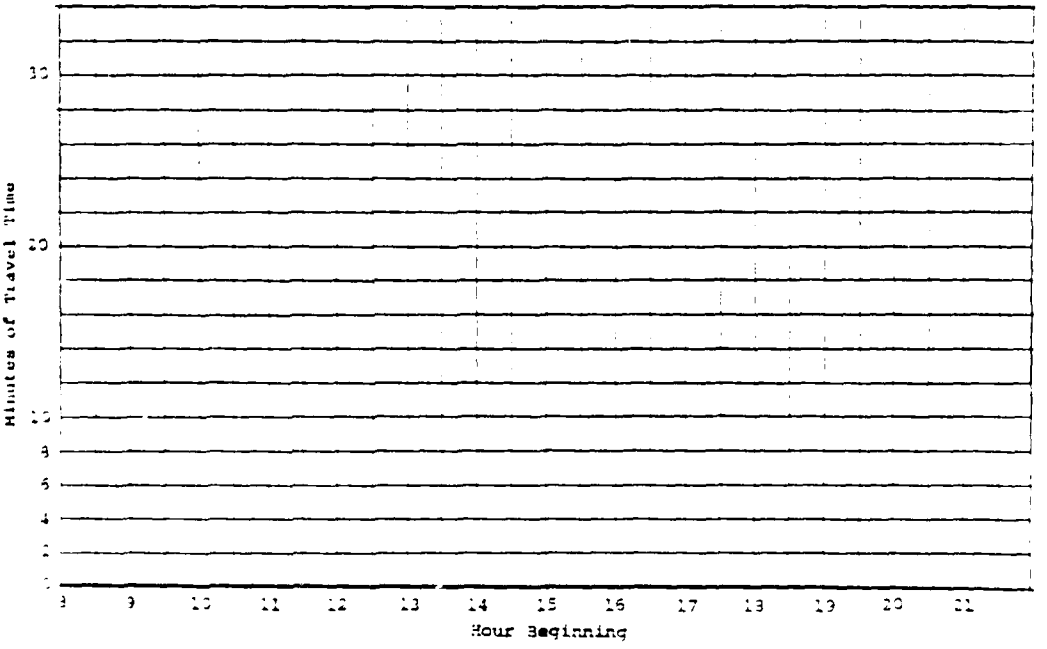


FIGURE 6 D--AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 12

Objective:

To determine average annual delays to aircraft in 1978.

Related Comparison Experiments:

None in Stage 1.

Results:

With the annual demand of 534,586 operations for the period July 1977 through June 1978, average annual delays were estimated to be 3.92 minutes per aircraft. Seventy-nine percent of the delays were less than or equal to two minutes.

On the average day of the peak month, peak hour average delays are as high as 9.0 minutes (during IFR1 weather conditions). For the most frequent weather condition (VFR1 weather), average peak hour delays were 6.7 minutes.

(See attached ADM output and list of inputs.)

```
**********************************
*   AIRPORT STUDY CONDITIONS     *
*       ATL 1978 BASELINE        *
**********************************
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ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	10.70
.1	TO	.2	9.35
.2	TO	.3	.35
.3	TO	.4	10.94
.4	TO	.5	19.38
.5	TO	.6	11.15
.6	TO	.7	9.10
.7	TO	.8	20.38
.8	TO	.9	11.39
.9	TO	1.0	2.72
1.0	TO	1.1	1.77
1.1	TO	1.2	.92
1.2	TO	1.3	.61

MEAN OF D/C RATIO = .50
STANDARD DEVIATION = .29

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	.500
.2	TO	.4	1.600
.4	TO	.6	1.541
.6	TO	.8	.059
.8	TO	1.0	1.126
1.0	TO	1.2	1.494
1.2	TO	1.4	4.098
1.4	TO	1.6	2.960
1.6	TO	1.8	4.726
1.8	TO	2.0	4.805
2.0	TO	3.0	9.604
3.0	TO	4.0	18.796
4.0	TO	5.0	25.775
5.0	TO	6.0	8.886
6.0	TO	7.0	5.989
7.0	TO	8.0	4.100
8.0	TO	9.0	.916
9.0	TO	10.0	.046
10.0	TO	11.0	.483
11.0	TO	12.0	.256
12.0	TO	13.0	.019
13.0	TO	14.0	.196
14.0	TO	15.0	.211
15.0	TO	16.0	.251
16.0	TO	17.0	.543

MEAN OF AVERAGE DELAY = 3.32
STANDARD DEVIATION = 1.33

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	30.4	6.7	0	0
1	2	7.6	8.9	2	1
1	3	.8	8.9	2	1
2	1	58.2	6.7	0	0
2	2	2.9	9.0	2	1
2	3	.2	8.9	2	1

ANNUAL DELAY = 34893.163 HOURS
ANNUAL DEMAND = 534586 OPERATIONS
AVERAGE DELAY = 3.92 MINUTES/AIRCRAFT

```
ANNUEMAND  1
  534586
GROUPS     2
    3   12     3     2
WHPERCENT  3
  .018  .019  .019  .019  .019  .019  .019  .020  .020  .020  .020  .020
1.000
WHNUMBER   4
  4.43  4.00  4.43  4.29  4.43  4.29  4.43  4.43  4.29  4.43  4.29  4.43
DPERCENT   5
  .150  .140  .135 2.000
DAYNUMBER  6
    3     2     2
WEAPCT     7
  .820  .970  .840  .930  .930 1.000  .930  .870  .840  .920  .720  .860
  .150  .030  .160  .070  .070 0.000  .070  .130  .160  .080  .220  .110
  .030 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000  .060  .030
CAPACITY   8
 72.0 58.6 38.1 92.8
 54.0 69.3 28.2 90.6
 54.0 54.0  0.0 95.2
 72.0 57.9 38.2 92.8
 54.0 68.6 28.2 90.6
 54.0 54.4  0.0 95.2
DEMFAC     9
 1.000 1.000  .900
 1.000 1.000  .900
RHYUSEPCT 10
  .343  .727  .800
  .657  .273  .200
HOURPCT   11
  .031  .016  .002  .003  .006  .020  .029  .010  .032  .067  .067  .063
  .061  .043  .049  .063  .068  .064  .064  .063  .053  .042  .032  .052
DEMPROFILE12
   50    50    50
   50    50    50
PCTARR    14
  .240  .310  .160  .440  .800  .770  .050  .260  .220  .690  .340  .630
  .340  .570  .530  .630  .460  .540  .310  .610  .270  .650  .320  .730
DWNDIVERT 15
 60.0120.00   .25
RUNID     16
 ATL 1978 BASELINE
```

(Revised)

INPUT DATA - EXPERIMENT NO. 12

Annual Delay Model

1. Annual Demand: 534,586 (last 6 months of 1977 and first 6 months of 1978).

2. Group Specification:

3 day groups	:	High, Average, Low
12 week groups	:	12 months, January through December
3 weather groups	:	VFR, IFR1, IFR2

2 runway uses :

	Arrivals Runway	Departures Runway
1.	8, 9R	8, 9L
2.	26, 27L	26, 27R

3. Weekly Traffic 1977:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
% of annual in one week	1.83	1.86	1.88	1.90	1.90	1.91	1.90	1.98	1.95	1.95	1.96	1.98

4. Number of Weeks in Each Group:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
Number of weeks	4.43	4.00	4.43	4.29	4.43	4.29	4.43	4.43	4.29	4.43	4.29	4.43

5. Daily Traffic (1977):

Day Group	1	2	3
% of weekly in one day	15.0	14.0	13.5

6. Number of Days in Each Group:

Day Group	1	2	3
Number of Days	3	2	2

7. Weather Group Demand Factors:

VFR:	1.00
IFR1:	1.00
IFR2:	0.90

8. Weather Occurrences:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
VFR	82	97	84	93	93	100	93	87	84	92	72	86
IFR1	15	3	16	7	7	0	7	13	16	8	22	11
IFR2	3	0	0	0	0	0	0	0	0	0	6	3

9. Hourly Runway Capacity:

Runway Use	Hourly Capacity VFR	IFR1	IFR2
1	132	110	68
2	132	110	68

10. Runway Use Occurrences*:

Runway Use	Percent Occurrence VFR	IFR1	IFR2
1	30.2	8.0	0.8
2	57.8	3.0	0.2

11. Hourly Traffic (1978):

Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic
00-01	3.1	06-07	2.9	12-13	6.1	18-19	6.4
01-02	1.6	07-08	1.0	13-14	4.3	19-20	6.3
02-03	0.2	08-09	3.2	14-15	4.9	20-21	5.3
03-04	0.3	09-10	6.7	15-16	6.3	21-22	4.2
04-05	0.6	10-11	6.7	16-17	6.8	22-23	3.2
05-06	2.0	11-12	6.3	17-18	6.4	23-24	5.2

12. Demand Profile Factor: 30%

13. Runway Use Demand Factor:

All runway uses accommodate air carrier and general aviation demand (Demand factor = 1.0).

14. Aircraft Mix:
1% Class A
13% Class B
71% Class C
15% Class D

---

* PMM&Co. estimates based on 1977 PMS records.

15. Percent Arrivals (1978):

Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals
00-01	24	06-07	5	12-13	34	18-19	31
01-02	31	07-08	28	13-14	57	19-20	61
02-03	16	08-09	72	14-15	53	20-21	27
03-04	44	09-10	69	15-16	63	21-22	63
04-05	80	10-11	34	16-17	46	22-23	32
05-06	77	11-12	63	17-18	59	23-24	78

16. User-Specified Title: ATL ANNUAL BASELINE

Attachment B

DATA FOR STAGE 2 EXPERIMENTS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

September 1978

Table B-1

ATLANTA TASK FORCE DELAY STUDIES
REVISED STAGE 2 EXPERIMENTS

Experiment No.	Model	Study Case	Arrival Runways	Departure Runways	Weather	Demand	ATC System Scenario	Near-Term Improvements	Comments
13	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	Pre-1985	Midfield
14	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	None	Old term.
15	ADM	n.a.	n.a.	n.a.	n.a.	1982	Today's	Pre-1985	Midfield
16	ADM	n.a.	n.a.	n.a.	n.a.	1982	Today's	None	Old term.
17	ASM	12	8R, 9L	8L, 9R	IFR1	1982	1982	8L/26R	Inboard arrivals
18	ASM	13	8L, 9R	8R, 9L	IFR1	1982	1982	8L/26R	Outboard arrivals
19	ASM	5	8, 9R	8, 9L	IFR1	1987	1987	Pre-1985	Midfield
20	ASM	5	8L, 9R	8R, 9L	IFR1	1987	1987	8L/26R	4th R/W
21	Undefined								
22	ASM	5	8, 9R	8, 9L	IFR1	1982	1982	No gate hold	Unconstrained
23	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	6 mo.-3 R/W's 6 mo.-2 R/W's	Cancellation Limit = 1 hr.
24	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	Post-1985	4 R/W's
25	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	None	3 R/W's
26	ADM	n.a.	n.a.	n.a.	n.a.	1987	Today's	Post-1985	4 R/W's
27	ADM	n.a.	n.a.	n.a.	n.a.	1987	Today's	None	3 R/W's
28	VASM	5	8, 9R	8, 9L	IFR1	1978	Today's	2 departure tracks per runway	Eliminates single departure track out 4 nautical miles

Table B-2

ATLANTA TASK FORCE DELAY STUDIES
REORGANIZATION OF STAGE 2
AIRFIELD SIMULATION MODEL EXPERIMENTS
AND
INDEX TO STAGE 2 INPUTS

Sequence No.	Experiment No.*	Model	Runways		Weather	Demand	ATC	Improvement	Index: Page
			Arrivals	Departures					
1	28	ASM	8, 9R	8, 9L	IFR1	1978	Todays	Existing	40
2	22	ASM	8, 9R	8, 9L	IRR1	1982	Near	Pre-1985	42
3	17	ASM	8R, 9L	8L, 9R	IFR1	1982	Near	Pre-1985	44
4	18	ASM	8L, 9R	8R, 9L	IFR1	1982	Near	Pre-1985	51
5	19	ASM	8, 9R	8, 9L	IFR1	1987	Inter.	Pre-1985	53
6	20	ASM	8L, 9R	8R, 9L	IFR1	1987	Inter.	Post-1985	60
7	21	ASM	(Undefined - to be defined by City)						62

*Refers to Numbers agreed to at Atlanta Task Force Meeting No. 4, July 12, 1978, and the Subgroup Meeting of August 25, 1978.

EXPERIMENT NO. 28

Objective:

To obtain 1978 delay estimates assuming that there are two departure tracks per runway, i.e., no environmental constraints, for the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Results of this experiment can be compared to the results of Experiment No. 2A of Stage 1 to evaluate benefits of relieving single departure track constraint.

Data Changes:

Unconstrained departure-departure separations are used in this experiment instead of the constrained values of Stage 1 Experiment No. 2A.

(See attached change sheet.)

Experiment Number: 2B (Input changes from experiment number 2A)

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
a. Logistics	
1 Title	ATC Stage 2 Experiments
2 Random number seeds	
3 Start and finish times	
4 Print options	
5 Airline names	
6 Processing options	
7 Truncation limits	
8 Time switch	
b. Airfield Physical Characteristics	
9 Airfield network	
10 Number of runways	
11 Runway identification	
12 Departure runway end links	
13 Runway crossing links	
14 Exit taxiway location	
15 Holding areas	
16 Airline gates	
17 General aviation basing areas	
c. ATC Procedures	
18 Aircraft separations	Unconstrained Dep./Dep. Separations*
19 Route data	
20 Two-way path data	
21 Common approach paths	
22 Vectoring delays	
23 Departure runway queue control	
24 Gate hold control	
25 Departure airspace constraints	
26 Departure queue	
27 Runway crossing delay control	
d. Aircraft Operational Characteristics	
28 Exit taxiway utilization	
29 Arrival runway occupancy times	
30 Touch-and-go runway occupancy times	
31 Departure runway occupancy times	
32 Taxi speeds	
33 Approach speeds	
34 Gate service times	
35 Airspace travel times	
36 Runway crossing times	
37 Lateness distribution	
38 Demand	

*According to Report No. FAA-EM-78-8A

EXPERIMENT NO. 22

Objective:

To obtain delay estimates for the case where there are no gate holds in 1982 at Midfield with near-term ATC separations and the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment No. 2 estimates the delays associated with an assumed gate-hold procedure where aircraft are held at the gates when the length of departure queue reaches 10 aircraft.

Data Changes:

Input data item No. 24, "Gate Hold Limits" will be changed from the current value of 10 to an arbitrarily large number, say 999.

(See attached change sheet.)

Experiment Number: 22 / Input changes from experiment number 2 /

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
1 Title	
2 Random number seeds	
3 Start and finish times	
4 Print options	
5 Airline names	
6 Processing options	
7 Truncation limits	
8 Time switch	
B. Airfield Physical Characteristics	
9 Airfield network	
10 Number of runways	
11 Runway identification	
12 Departure runway end links	
13 Runway crossing links	
14 Exit taxiway location	
15 Holding areas	
16 Airline gates	
17 General aviation basing areas	
C. ATC Procedures	
18 Aircraft separations	
19 Route data	
20 Two-way path data	
21 Common approach paths	
22 Vectoring delays	
23 Departure runway queue control	
24 Gate hold control	Change from "10" to "999."
25 Departure airspace constraints	
26 Departure queue	
27 Runway crossing delay control	
D. Aircraft Operational Characteristics	
28 Exit taxiway utilization	
29 Arrival runway occupancy times	
30 Touch-and-go runway occupancy times	
31 Departure runway occupancy times	
32 Taxi speeds	
33 Approach speeds	
34 Gate service times	
35 Airspace travel times	
36 Runway crossing times	
37 Lateness distribution	
38 Demand	

EXPERIMENT NO. 17

Objective:

To obtain delay estimates for 1982 demand, near-term ATC, Midfield, and the fourth runway, 8L/26R, where the "inboard" runways are used for arrivals with the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8R, 9L	8L, 9R

Related Comparison Experiments:

Experiment No. 18 estimates the delay for the same case but with arrivals on the "outboard" runways. Experiment No. 20 also has arrivals on the "outboard" runways, but in 1987. Experiment No. 2 is the corresponding 3-runway case.

Data Changes and Needs:

- Runway assignments in the schedule.
- ATC procedures for departures crossing the arrival runways.

(See attached data input sheets.)

INPUT DATA FOR EXPERIMENT NO. 17

A. LOGISTICS

1. Title: Atlanta International Airport Airfield Simulation Model: Stage 2 Experiments

2. Random Number Seeds: 2017, 3069, 4235, 5873, 6981, 7137, 8099, 9355, 0123, 1985.

3. Start and Finish Times: 0830 to 2130 EDT in 1-hour summaries.

4. Print Options: 1-hour summaries for ten random number seeds.

5. Airline Names:

Name	Code
Air Freight	AF
Air Taxi	AT
Braniff	BN
Delta	DL
Eastern	EA
Northwest	NW
Piedmont	PI
Southern	SO
Trans World	TW
United	UA
General Aviation	GA

6. Processing Options: First run to check model input. Other runs in COMPUTE mode.

7. Truncation Limits: ± 3 standard deviations.

8. Time Switch: Not applicable.

B. AIRFIELD PHYSICAL CHARACTERISTICS

9. Airfield Network: See Figure C-5.

10. Number of Runways: 4.

11. Runway Identification: 8L, 8R, 9L, 9R.

AD-A092 455 PEAT MARWICK MITCHELL AND CO SAN FRANCISCO CALIF F/G 1/5
TASK FORCE DELAY STUDY. WILLIAM B. HARTSFIELD ATLANTA INTERNATI--ETC(U)
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2 OF 3
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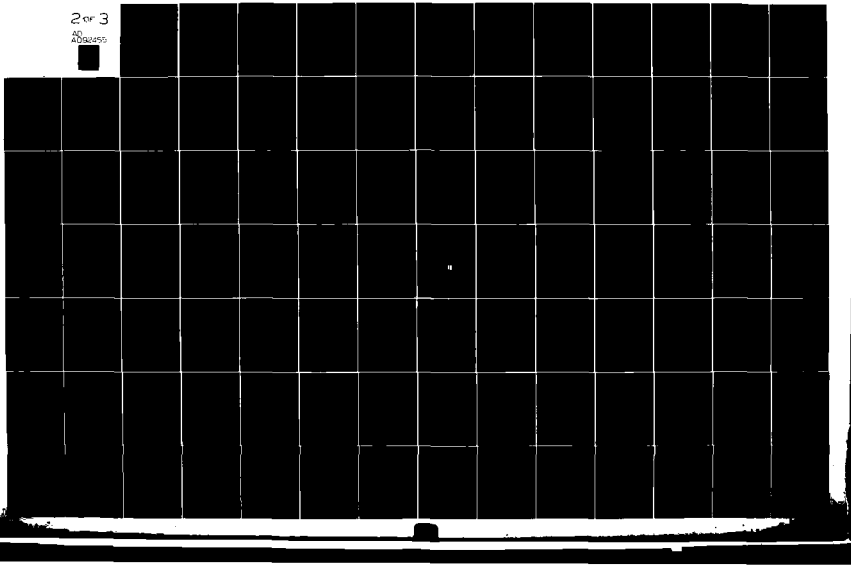


12. Departure Runway End Links: 340, 378.

13. Runway Crossing Links: 299, 300, 374, 448, 451.

14. Exit Taxiway Location:

Runway	Taxiway Link	Distance Threshold (Feet)
9L	331	4,650
9L	333	6,600
8R	371	9,300
8R	372	6,450
8R	373	4,875
8R	443	6,695
8R	447	4,500
8R	449	4,050

15. Holding Areas: Holding for (a) EA at north end of Runway 15, link 141, and (b) DL on taxiways P and R as appropriate.

16. Airline Gates: See Figure C-6.

17. General Aviation Basing Areas: Two areas, one to west of terminal area and one to east of terminal area (see Figure C-5).

C. ATC PROCEDURES

18. Aircraft Separations: These values are based on Report No. FAA-EM-78-8A.

Arrival-Arrival Separation (n.m.)

IFR Near-Term:

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	3.7	3.9	3.9	4.0
	B	3.7	2.9	3.9	4.0
	C	3.7	3.9	3.9	4.0
	D	4.7	4.9	3.9	4.0

Departure-Departure Separations (Seconds)

IFR Near-Term:

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	60	60	60	60
	B	60	60	60	60
	C	60	60	60	60
	D	120	120	120	90

Departure-Arrival Separation (n.m.)

IFR Todays:

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	2.0	2.0	2.0	2.0
	B	2.0	2.0	2.0	2.0
	C	2.0	2.0	2.0	2.0
	D	2.0	2.0	2.0	2.0

Arrival-Departure Separations (Seconds)

Arrival runway occupancy times.

19. Route Data: (Under development)

20. Two-Way Path Data: 285-552
441-131

Two-way taxiways are located as follows:

131-441
172 575 440 130

21. Common Approach Paths:

Arrival Runway	Aircraft Class	Length of Common Approach Path
8R	A	4.0
	B	4.0
	C	5.0
	D	5.0
9L	A	4.0
	B	4.0
	C	5.0
	D	5.0

22. Vectoring Delays:

This input allocates delays among vectoring and holding. Model input values will be used that hold arrival aircraft if delays to arrival aircraft exceed 10 minutes.

23. Departure Runway Queue Control:

Aircraft are assigned departure runways to preclude airspace corssovers, not to balance departure queues.

24. Gate Hold Control:

Aircraft are held at gates when departure queue at runway is 10 or more, except when gate holds would cause gate congestion.

25. Departure Airspace Constraints:

Aircraft are not held at gates due to departure airspace constraints.

26. Inter-Arrival Gap:

With this runway use, arrival aircraft are delayed in the arrival airspace when departure delays exceed 10 minutes.

27. Runway Crossing Delay Control:

Arrival and departure runway operations are only interrupted for a taxiing aircraft to cross an active runway when the taxiing aircraft is delayed by 4 minutes or more.

D. AIRCRAFT OPERATIONAL CHARACTERISTICS

28. Exit Taxiway Utilization:

		Exit Utilization (Percent)					
	A/C Class	449	447	373	372	443	371
Runway 8R	A	100	0	0	0	0	0
	B	98	2	0	0	0	0
	C	8	15	14	73	0	0
	D	0	1	8	89	2	1

		Exit Utilization (Percent)	
	A/C Class	345	346
Runway 9L	A	100	0
	B	100	0
	C	50	50
	D	16	82

29. Arrival Runway Occupancy Times:

		Runway Occupancy Time (Second)					
	A/C Class	449	447	373	372	443	371
Runway 8R	A	50	-	-	-	-	-
	B	47	51	-	-	-	-
	C	38	42	47	60	-	-
	D	-	42	47	60	63	65

	A/C Class	345	346
Runway 9L	A	-	-
	B	-	-
	C	40	59
	D	40	59

30. Touch & Go Occupancy Times:

Aircraft Class	Runway Occupancy Time (Seconds)	
	Mean	Standard Deviation
A	22	3
B	23	3
C	27	4
D	27	4

31. Departure Runway Occupancy Times:

Aircraft Class	Runway Occupancy Time (Seconds)	
	Mean	Standard Deviation
A	34	3
B	34	3
C	39	4
D	39	4

32. Taxi Speeds: To be based on coded network and calibration.

33. Approach Speeds:

Aircraft Class	Approach Speed (Knots) Mean	Standard Deviation
A	95	10
B	120	10
C	130	10
D	140	10

34. Gate Service Times: See Table C-1.

35. Airspace Travel Times: To be based on reduced field data.

36. Runway Crossway Times: 20 seconds.

37. Lateness Distribution: See Table C-2.

38. Demand: Computer printout available - copy provided to Task Force Chairman.

EXPERIMENT NO. 18

Objective:

To obtain delay estimates for 1982 demand, near-term ATC, Midfield Terminal, and the fourth runway, 8L/26R, where the "outboard" runways are used for arrivals with the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 17 estimates the delay for the same case but with arrivals, on the "inboard" runways. Experiment No. 20 is for "outboard" case but with 1987 demand and ATC scenario. Experiment No. 2 is the corresponding 3-runway case.

Data Changes and Needs:

- Runway assignments for schedule
- ATC procedures for arrivals crossing the departure runways

(See attached change sheet.)

Experiment Number: 18 (Input changes from experiment number 17)

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
a. Logistics	
1 Title	
2 Random number seeds	
3 Start and finish times	
4 Print options	
5 Airline names	
6 Processing options	
7 Truncation limits	
8 Time switch	
b. Airfield Physical Characteristics	
9 Airfield network	
10 Number of runways	
11 Runway identification	
12 Departure runway end links	8R & 9L instead of 8L & 9R
13 Runway crossing links	Arrivals cross departure runways
14 Exit taxiway location	on 8L and 9R
15 Holding areas	
16 Airline gates	
17 General aviation basing areas	
c. ATC Procedures	
18 Aircraft separations	
19 Route data	Exits on 8L & 9R; departure on 8R & 9L
20 Two-way path data	for new routing
21 Common approach paths	
22 Vectoring delays	
23 Departure runway queue control	
24 Gate hold control	
25 Departure airspace constraints	
26 Departure queue	
27 Runway crossing delay control	
d. Aircraft Operational Characteristics	
28 Exit taxiway utilization	For 8L & 9R exits
29 Arrival runway occupancy times	For 8L & 9R
30 Touch-and-go runway occupancy times	
31 Departure runway occupancy times	For 8R & 9L
32 Taxi speeds	Same by link
33 Approach speeds	
34 Gate service times	
35 Airspace travel times	May differ slightly
36 Runway crossing times	For arrivals across departure runways
37 Lateness distribution	
38 Demand	

EXPERIMENT NO. 19

Objective:

To obtain delay estimates for 1987 demand, intermediate-term ATC, Midfield Terminal, and the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment No. 2 estimates the delays for the same conditions in 1982. Experiment No. 20 has the same 1987 demand and ATC but with the fourth runway 8L/26R and arrivals on the "outboard" runways.

Data Changes and Needs:

- 1987 schedule and assignments (fix, gate, and runway)

(See attached data input summary.)

INPUT DATA FOR EXPERIMENT NO. 19

A. LOGISTICS

1. Title: Atlanta International Airport Airfield Simulation Model: Stage 2 Experiments

2. Random Number Seeds: 2017, 3069, 4235, 5873, 6981, 7137, 8099, 9355, 0123, 1985.

3. Start and Finish Times: 0830 to 2130 EDT by 1-hour summaries.

4. Print Options: Summaries for ten random number seeds.

5. Airline Names:

Name	Code
Air Freight	AF
Air Taxi	AT
Braniff	BN
Delta	DL
Eastern	EA
Northwest	NW
Piedmont	PI
Southern	SO
Trans World	TW
United	UA
General Aviation	GA

6. Processing Options: First run to check model input. Other runs in COMPUTE mode.

7. Truncation Limits: ± 3 standard deviations.

8. Time Switch: Not applicable.

B. AIRFIELD PHYSICAL CHARACTERISTICS

9. Airfield Network: See Figure C-3.

10. Number of Runways: 3.

11. Runway Identification: 8, 9L, 9R.

12. Departure Runway End Links: 340, 378

13. Runway Crossing Links: 299, 300, 374, 448, 451.

14. Exit Taxiway Location:

Runway	Taxiway Link	Distance Threshold (Feet)
9L	331	4,650
9L	333	6,600
8R	371	9,300
8R	372	6,450
8R	373	4,875
8R	443	6,695
8R	447	4,500
8R	449	4,050

15. Holding Areas: Holding for (a) EA at north end of Runway 15, and (b) DL on taxiways P and R as appropriate.

16. Airline Gates: See Figure C-6.

17. General Aviation Basing Areas: Two areas, one to west of terminal area and one to east of terminal area (see Figure C-1).

C. ATC PROCEDURES

18. Aircraft Separations: These values are based on Report No. FAA-EM-78-8A.

Arrival-Arrival Separation (n.m.)

IFR Intermediate-Term:

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	2.5	2.6	2.7	2.7
	B	2.5	2.6	2.7	2.7
	C	3.0	3.1	2.7	2.7
	D	3.5	3.6	3.2	2.7

Departure-Departure Separations (Seconds)

IFR Interimate-Term:

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	60	60	60	60
	B	60	60	60	60
	C	60	60	60	60
	D	90	90	90	90

Departure-Arrival Separation (n.m.):

Assume half-way down to current VFR levels:

		Trail Aircraft Class			
		A	B	C	D
Lead Aircraft Class	A	1.5	1.6	1.6	1.7
	B	1.5	1.6	1.6	1.7
	C	1.5	1.7	1.7	1.8
	D	1.5	1.7	1.7	1.8

Arrival-Departure Separations (Seconds)

Arrival runway occupancy times.

19. Route Data: See Figure C-4.

20. Two-Way Path Data:

Two-way taxiways are located as follows:

285-552
441-131
131-441
172 575 440 130

21. Common Approach Paths:

Arrival Runway	Aircraft Class	Length of Common Approach Path
8	A	4.0
	B	4.0
	C	5.0
	D	5.0
9R	A	4.0
	B	4.0
	C	5.0
	D	5.0

22. Vectoring Delays:

This input allocates delays among vectoring and holding. Model input values will be used that hold arrival aircraft if delays to arrival aircraft exceed 10 minutes.

23. Departure Runway Queue Control:

Aircraft are assigned departure runways to preclude airspace corssovers, not to balance departure queues.

24. Gate Hold Control:

Aircraft are held at gates when departure queue at runway is 10 or more, except when gate holds would cause gate congestion.

25. Departure Airspace Constraints:

Aircraft are not held at gates due to departure airspace constraints.

26. Inter-Arrival Gap:

With this runway use, arrival aircraft are delayed in the arrival airspace when departure delays exceed 10 minutes.

27. Runway Crossing Delay Control:

Arrival and departure runway operations are only interrupted for a taxiing aircraft to cross an active runway when the taxiing aircraft is delayed by 4 minutes or more.

D. AIRCRAFT OPERATIONAL CHARACTERISTICS

28. Exit Taxiway Utilization:

		Exit Utilization (Percent)					
	A/C Class	449	447	373	372	443	371
Runway 8	A	100	0	0	0	0	0
	B	98	2	0	0	0	0
	C	8	15	14	73	0	0
	D	0	1	8	89	2	1

	A/C Class	Exit Utilization (Percent) 331	333
Runway 9R	A	100	0
	B	100	0
	C	50	50
	D	16	84

29. Arrival Runway Occupancy Times:

	A/C Class	Runway Occupancy Time (Second) 449	447	373	372	443	371
Runway 8	A	-	-	-	-	-	-
	B	47	51	-	-	-	-
	C	38	42	47	60	63	-
	D	-	42	47	60	63	65

	A/C Class	331	333
Runway 9R	A	-	-
	B	-	-
	C	40	59
	D	40	59

30. Touch & Go Occupancy Times:

Aircraft Class	Runway Occupancy Time (Seconds) Mean	Standard Deviation
A	22	3
B	23	3
C	27	4
D	27	4

31. Departure Runway Occupancy Times:

Aircraft Class	Runway Occupancy Time (Seconds) Mean	Standard Deviation
A	34	3
B	34	3
C	39	4
D	39	4

32. Taxi Speeds: To be based on coded network and calibration.

33. Approach Speeds:

Aircraft Class	Approach Speed (Knots) Mean	Standard Deviation
A	95	10
B	120	10
C	130	10
D	140	10

34. Gate Service Times: See Table C-1.

35. Airspace Travel Times: To be based on reduced field data.

36. Runway Crossway Times: 20 seconds.

37. Lateness Distribution: See Table C-2.

38. Demand: Computer printout available - copy will be provided to Task Force Chairman along with results of Stage 2 runs.

EXPERIMENT NO. 20

Objective:

To obtain delay estimates for 1987 demand, intermediate-term ATC, Midfield Terminal, the fourth runway 8L/26R, and the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 18 estimates the delays for the same conditions in 1982. Experiment No. 19 has the same 1987 demand and ATC, but without the fourth runway.

Data Changes and Needs:

- 1987 schedule and assignments (fourth runway)

(See attached change sheet.)

Experiment Number: 20 (Input changes from experiment number 19)

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
a. Logistics	
1 Title	
2 Random number seeds	
3 Start and finish times	
4 Print options	
5 Airline names	
6 Processing options	
7 Truncation limits	
8 Time switch	
b. Airfield Physical Characteristics	
9 Airfield network	
10 Number of runways	Fourth runway 8L/26R
11 Runway identification	8L/26R
12 Departure runway end links	
13 Runway crossing links	For arrivals on 8L
14 Exit taxiway location	For 8L
15 Holding areas	
16 Airline gates	
17 General aviation basing areas	
c. ATC Procedures	
18 Aircraft separations	
19 Route data	For 8L exits
20 Two-way path data	From 8L
21 Common approach paths	
22 Vectoring delays	
23 Departure runway queue control	For 8L-8R
24 Gate hold control	
25 Departure airspace constraints	
26 Departure queue	
27 Runway crossing delay control	
d. Aircraft Operational Characteristics	
28 Exit taxiway utilization	For 8L
29 Arrival runway occupancy times	For 8L
30 Touch-and-go runway occupancy times	
31 Departure runway occupancy times	
32 Taxi speeds	
33 Approach speeds	
34 Gate service times	
35 Airspace travel times	For 8L
36 Runway crossing times	For arrivals on 8L
37 Lateness distribution	
38 Demand	

EXPERIMENT NO. 21

Objective:

To be defined by Task Force.

Related Comparison Experiments:

To be defined by Task Force.

Data Changes and Needs:

To be defined by Task Force.

Experiment Number: 21 (Input changes from experiment number ____)

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
a. Logistics	
1 Title	
2 Random number seeds	
3 Start and finish times	
4 Print options	
5 Airline names	
6 Processing options	
7 Truncation limits	
8 Time switch	
b. Airfield Physical Characteristics	
9 Airfield network	
10 Number of runways	
11 Runway identification	
12 Departure runway end links	
13 Runway crossing links	
14 Exit taxiway location	
15 Holding areas	
16 Airline gates	
17 General aviation basing areas	
c. ATC Procedures	
18 Aircraft separations	
19 Route data	
20 Two-way path data	
21 Common approach paths	
22 Vectoring delays	
23 Departure runway queue control	
24 Gate hold control	
25 Departure airspace constraints	
26 Departure queue	
27 Runway crossing delay control	
d. Aircraft Operational Characteristics	
28 Exit taxiway utilization	
29 Arrival runway occupancy times	
30 Touch-and-go runway occupancy times	
31 Departure runway occupancy times	
32 Taxi speeds	
33 Approach speeds	
34 Gate service times	
35 Airspace travel times	
36 Runway crossing times	
37 Lateness distribution	
38 Demand	

Table B-3

LIST OF STAGE 2 ANNUAL DELAY MODEL (ADM) EXPERIMENTS AND INDEX TO INPUT DATA

Sequence No.	Stage 2 Experiment No.	Demand	ATC System	Terminal	No. of Runways	Page
1	16	1982	Today	Old	3	65
2	14	1982	1982	Old	3	69
3	15	1982	Today	New	3	70
4	13	1982	1982	New	3	71
5	27	1987	Today	Old	3	72
6	25	1987	→ 1987 ✓	Old	3	76
7	26	1987	Today	New	4	77
8	24	1987	→ 1987 ✓	New	4	78
9	23	~~1987~~	→ ~~1987~~	New	6 mo. - 3 6 mo. - 4	79

EXPERIMENT NO. 16

Objective:

To obtain estimates of average annual delays and distribution of delays to aircraft assuming 1982 demand, today's ATC system, the old terminal, and three runways.

Related Comparison Experiments:

Experiment No. 14 is same but with near-term ATC.
Experiment No. 15 is the same but with new terminal.
Experiment No. 13 is same but with both near-term ATC and new terminal.

(See attached input data summary.)

INPUT DATA - EXPERIMENT NO. 16

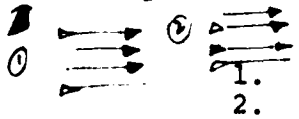
Annual Delay Model

1. Annual Demand: 620,000 (1982)

2. Group Specification:

3 day groups : High, Average, Low
12 week groups : 12 months, January through December
3 weather groups: VFR, IFR1, IFR2

2 runway uses : Arrivals Runway / Departures Runway



1. 8, 9R / 8, 9L
2. 26, 27L / 26, 27R

3. Weekly Traffic 1977 (Same distributior assumed for 1982):*

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
% of annual in one week	1.83	1.86	1.88	1.90	1.90	1.91	1.90	1.98	1.95	1.95	1.96	1.98

4. Number of Weeks in Each Group:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
Number of weeks	4.43	4.00	4.43	4.29	4.43	4.29	4.43	4.43	4.29	4.43	4.29	4.43

5. Daily Traffic (1977):

Day Group	1	2	3
% of weekly in one day	15.0	14.0	13.5

6. Number of Days in Each Group:

Day Group	1	2	3
Number of Days	3	2	2

7. Weather Group Demand Factors:

VFR: 1.00
IFR1: 1.00
IFR2: 0.90

---

*Peat, Marwick, Mitchell & Co. estimates based on 1977 PMS records and Atlanta ATC Tower Counts.

8. Weather Occurrences:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
VFR	82	97	84	93	93	100	93	87	84	92	72	86
IFR1	15	3	16	7	7	0	7	13	16	8	22	11
IFR2	3	0	0	0	0	0	0	0	0	0	6	3

9. Hourly Runway Capacity:

Runway Use	Hourly Capacity VFR	IFR1	IFR2
1	(under development)		
2			

10. Runway Use Occurrences*:

Runway Use	Percent Occurrence VFR	IFR1	IFR2
1	30.2	8.0	0.8
2	57.8	3.0	0.2

11. Hourly Traffic (1978):

Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic
00-01	3.1	06-07	2.9	12-13	6.1	18-19	6.4
01-02	1.6	07-08	1.0	13-14	4.3	19-20	6.3
02-03	0.2	08-09	3.2	14-15	4.9	20-21	5.3
03-04	0.3	09-10	6.7	15-16	6.3	21-22	4.2
04-05	0.6	10-11	6.7	16-17	6.8	22-23	3.2
05-06	2.0	11-12	6.3	17-18	6.4	23-24	5.2

12. Demand Profile Factor: 30%

13. Runway Use Demand Factor:

All runway uses accommodate air carrier and general aviation demand (Demand factor = 1.0).

14. Aircraft Mix:
1% Class A
13% Class B
75% Class C
11% Class D

---

* PMM&Co. estimates based on 1977 PMS records. Assumed same for 1982.

15. Percent Arrivals (1978):

Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals
00-01	24	06-07	5	12-13	34	18-19	31
01-02	31	07-08	28	13-14	57	19-20	61
02-03	16	08-09	72	14-15	53	20-21	27
03-04	44	09-10	69	15-16	63	21-22	63
04-05	80	10-11	34	16-17	46	22-23	32
05-06	77	11-12	63	17-18	59	23-24	78

16. User-Specified Title: ATL ANNUAL DELAY NO. 16.

EXPERIMENT NO. 14

Objective:

To obtain estimates of average annual delays and distributions of delays to aircraft for 1982 demand, near-term ATC system, and the old terminal.

Related Comparison Experiments:

See Table B-3 and Experiment No. 16.

Data Changes From Experiment No. 16:

- Capacities for near-term separations

EXPERIMENT NO. 15

Objective:

To obtain estimates of average annual delays and distributions of delays to aircraft for 1982 demand, today's ATC system, and the new terminal building.

Related Comparison Experiments:

See Table B-3 and Experiment No. 16.

Data Changes From Experiment No. 16:

- New capacities and demand-delay relationships associated with new terminal area location

EXPERIMENT NO. 13

Objective:

To obtain estimates of average annual delays and distributions of delays to aircraft for 1982 demand, near-term ATC system, and the new terminal building.

Related Comparison Experiments:

See Table B-3 and Experiment No. 16.

Data Changes From Experiment No. 16:

- Capacities for near-term ATC separations
- Capacities and demand-delay relationships associated with new terminal area location

EXPERIMENT NO. 27

Objective:

To obtain estimates of average annual delays and distributions of delays to aircraft for the 1987 demand imposed on today's ATC system, terminal building, and 3 runways.

Related Comparison Experiments:

(See Table C-3.) Experiments 25, 26, 24, and 23 have same demand, but they have different ATC, terminal, or number of runways.

(See attached input data summary.)

INPUT DATA - EXPERIMENT NO. 27

Annual Delay Model

1. Annual Demand: 690,000 (1987)*

2. Group Specification:

3 day groups	:	High, Average, Low
12 week groups	:	12 months, January through December
3 weather groups	:	VFR, IFR1, IFR2

2 runway uses	:	Arrivals Runway	Departures Runway
	1.	8, 9R	8, 9L
	2.	26, 27L	26, 27R

3. Weekly Traffic 1977 (assumed unchanged):

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
% of annual in one week	1.83	1.86	1.88	1.90	1.90	1.91	1.90	1.98	1.95	1.95	1.96	1.98

4. Number of Weeks in Each Group:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
Number of weeks	4.43	4.00	4.43	4.29	4.43	4.29	4.43	4.43	4.29	4.43	4.29	4.43

5. Daily Traffic (1977):

Day Group	1	2	3
% of weekly in one day	15.0	14.0	13.5

6. Number of Days in Each Group:

Day Group	1	2	3
Number of Days	3	2	2

7. Weather Group Demand Factors:

VFR:	1.00
IFR1:	1.00
IFR2:	0.90

*PMM&Co. estimate based on ATA and FAA forecasts.

8. Weather Occurrences:

Week Group	1	2	3	4	5	6	7	8	9	10	11	12
VFR	82	97	84	93	93	100	93	87	84	92	72	86
IFR1	15	3	16	7	7	0	7	13	16	8	22	11
IFR2	3	0	0	0	0	0	0	0	0	0	6	3

9. Hourly Runway Capacity (Today's ATC System):

Runway Use	Hourly Capacity VFR	IFR1	IFR2
1	Under development		
2			

10. Runway Use Occurrences*:

Runway Use	Percent Occurrence VFR	IFR1	IFR2
1	30.2	8.0	0.8
2	57.8	3.0	0.2

11. Hourly Traffic (1978):

Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic	Hour	% daily traffic
00-01	3.1	06-07	2.9	12-13	6.1	18-19	6.4
01-02	1.6	07-08	1.0	13-14	4.3	19-20	6.3
02-03	0.2	08-09	3.2	14-15	4.9	20-21	5.3
03-04	0.3	09-10	6.7	15-16	6.3	21-22	4.2
04-05	0.6	10-11	6.7	16-17	6.8	22-23	3.2
05-06	2.0	11-12	6.3	17-18	6.4	23-24	5.2

12. Demand Profile Factor: 30%

13. Runway Use Demand Factor:

All runway uses accommodate air carrier and general aviation demand (Demand factor = 1.0).

14. Aircraft Mix:
1% Class A
13% Class B
69% Class C
17% Class D

---

* PMM&Co. estimates based on 1977 PMS records.

15. Percent Arrivals (1978):

Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals	Hour	% Arrivals
00-01	24	06-07	5	12-13	34	18-19	31
01-02	31	07-08	28	13-14	57	19-20	61
02-03	16	08-09	72	14-15	53	20-21	27
03-04	44	09-10	69	15-16	63	21-22	63
04-05	80	10-11	34	16-17	46	22-23	32
05-06	77	11-12	63	17-18	59	23-24	78

16. User-Specified Title: ATL ANNUAL INIMPROVED DELAY FOR 1987.

EXPERIMENT NO. 25

Objective:

To obtain estimates of average annual delays and the distribution of delays to aircraft for 1987 demand, Intermediate-Term ATC system, the old terminal, and 3 runways.

Related Comparison Experiments:

See Table B-3 and Experiment No. 27.

Data Changes From Experiment No. 27:

- Capacities for Intermediate-Term ATC system

EXPERIMENT NO. 26

Objective:

To obtain estimates of average annual delays and the distribution of delays to aircraft for 1987 demand, today's ATC system, the new terminal, and 4 runways.

Related Comparison Experiments:

See Table B-3 and Experiment No. 27.

Data Changes From Experiment No. 27:

- Capacities and demand-delay relationships for 4 runways and the new terminal location

EXPERIMENT NO. 24

Objective:

To obtain estimates of average annual delays and the distribution of delays to aircraft for 1987 demand, intermediate-term ATC system, the new terminal, and 4 runways.

Related Comparison Experiments:

See Table B-3 and Experiment No. 27.

Data Changes From Experiment No. 27:

- Capacities for ~~intermediate~~-term separations, 4 runways, and the new terminal location
- Demand-delay relationships for the new terminal location

EXPERIMENT NO. 23

Objective:

To obtain estimates of average annual delays and the distribution of delays to aircraft for 1987 demand, intermediate-term ATC system, new terminal, 3 runways for 6 months and 4 runways for 6 months.

Related Comparison Experiments:

See Table B-3 and Experiment No. 27.

Data Changes From Experiment No. 27:

- Capacities for intermediate-term separations, 3 and 4 runways, and the new terminal location
- Demand-delay relationships for the new terminal location
- Decision on which 6 months or on how to change seasonal distributions, etc.

Attachment C

COMMON INPUT DATA:

- Airfield Networks
- Taxiway Flows
- Lateness Distribution
- Gate Service Time Distribution

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

September 1978

Table C-1

ARRIVAL AIRCRAFT LATENESS DISTRIBUTION
(Average deviation from schedule, excluding delays due to destination airport)

Amount of Time Late or Early	Cumulative Probability
Less than 15 min. early	0.00
Less than 0.1 min. early	0.02
Less than 0.1 min. late	0.65
Less than 5 min. late	0.78
Less than 10 min. late	0.85
Less than 15 min. late	0.90
Less than 30 min. late	0.95
Less than 45 min. late	0.98
Less than 60 min. late	0.99
Less than 65 min. late	1.00

Source: Peat, Marwick, Mitchell & Co., analysis of data provided by Atlanta Task Force.

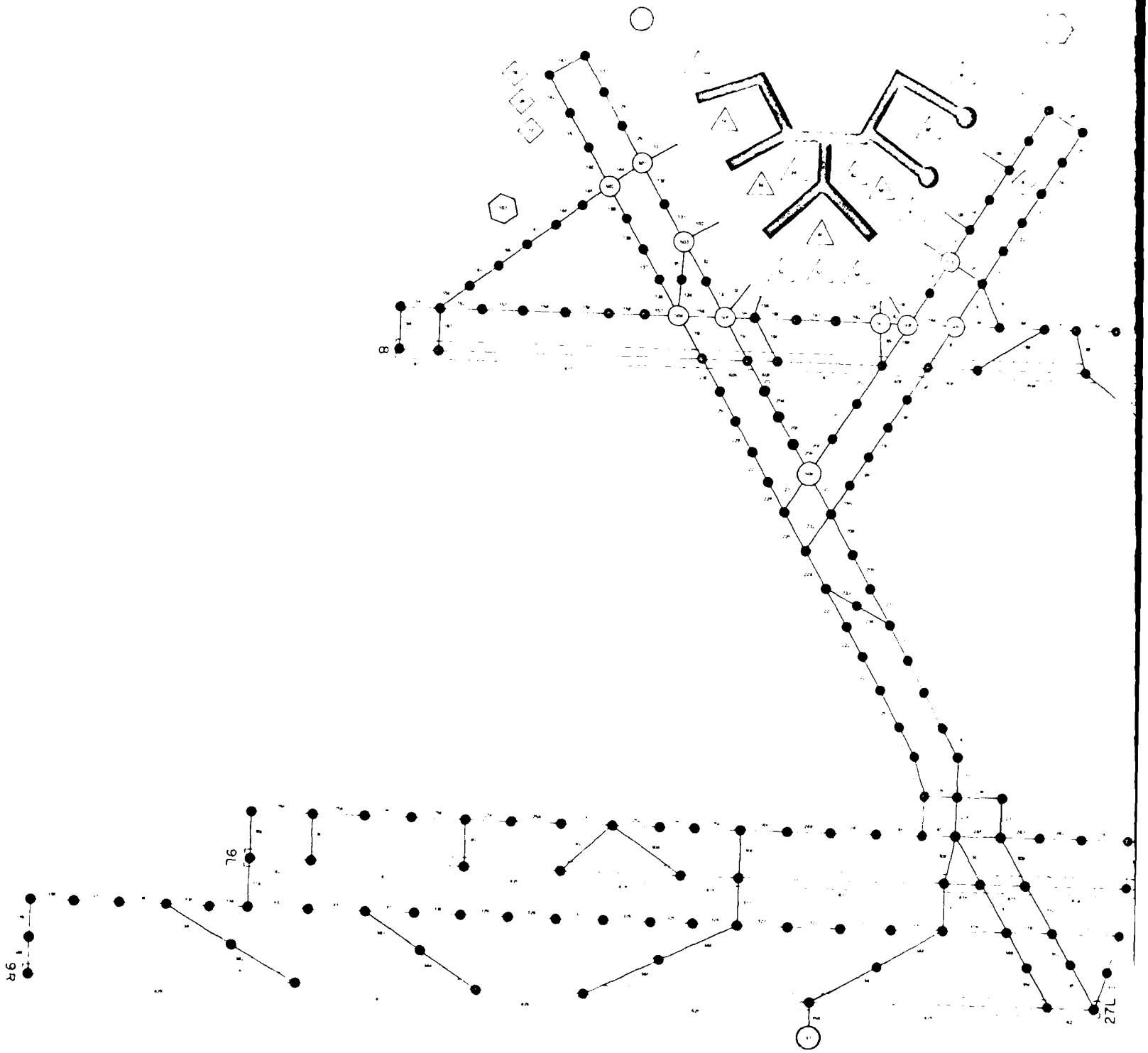
Table C-2

GATE SERVICE TIME DISTRIBUTION
Atlanta Task Force Delay Studies

Aircraft Class	Histogram Points (Times are in Minutes)									
	Point 1		Point 2		Point 3		Point 4		Point 5	
	Time	Prob.*	Time	Prob.	Time	Prob.	Time	Prob.	Time	Prob.
A	10	0.40	15	0.40	20	0.10	25	0.10		
B	15	0.40	20	0.07	25	0.09	30	0.04	35	0.40
C	25	0.47	30	0.13	50	0.40				
D	25	0.07	30	0.04	35	0.40	38	0.09	55	0.40

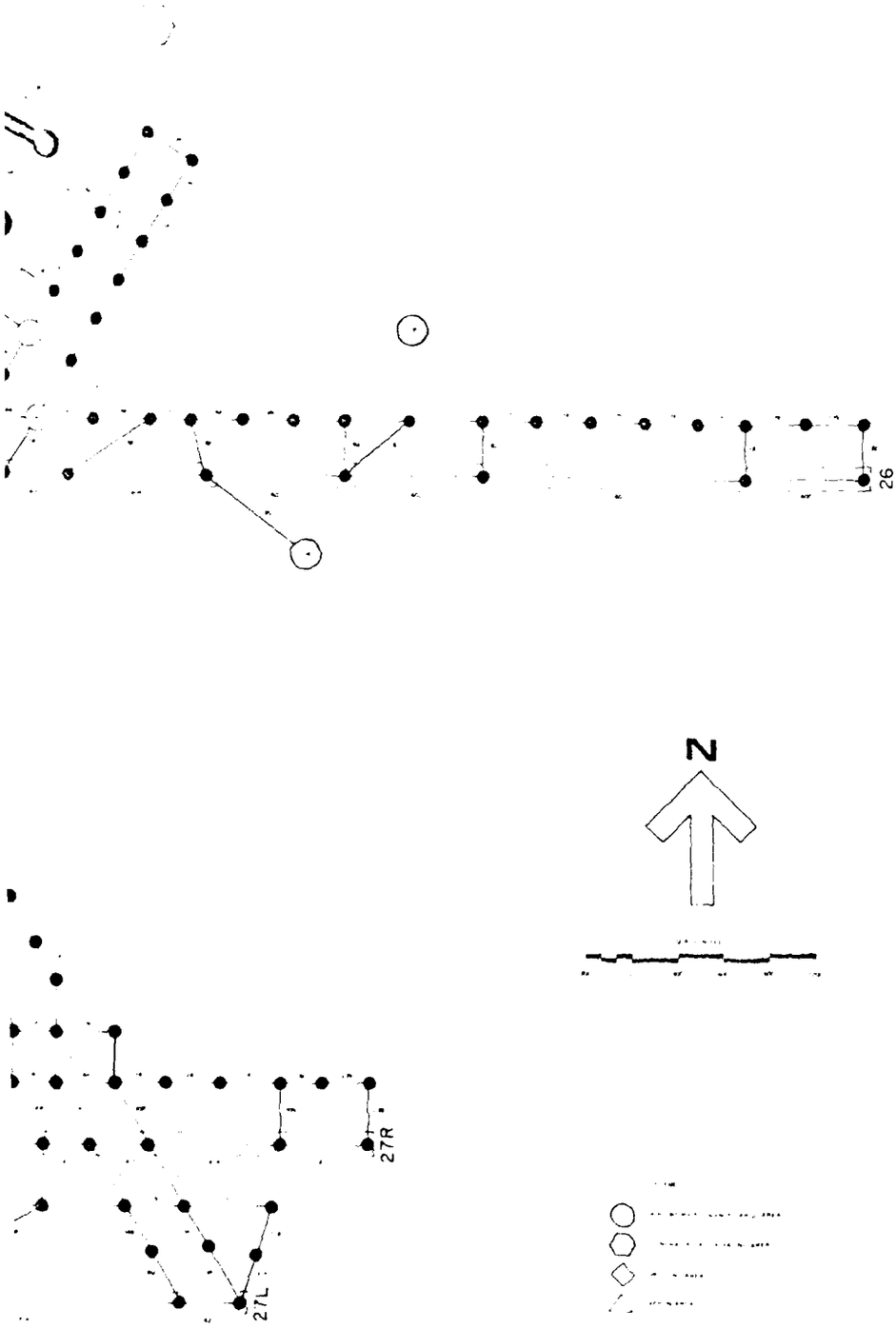
*These probabilities add up to 1.0 across the rows.

Source: Peat, Marwick, Mitchell & Co., analysis of data provided by Atlanta Task Force.



AIRFIELD NETWORK

WILLIAM B. HARTSFIELD ATLANTA INTERNATIO



ORK

NTERNATIONAL AIRPORT

Figure C-1

AIRFIELD NETWORK FOR 1978
SIMULATION RUNS

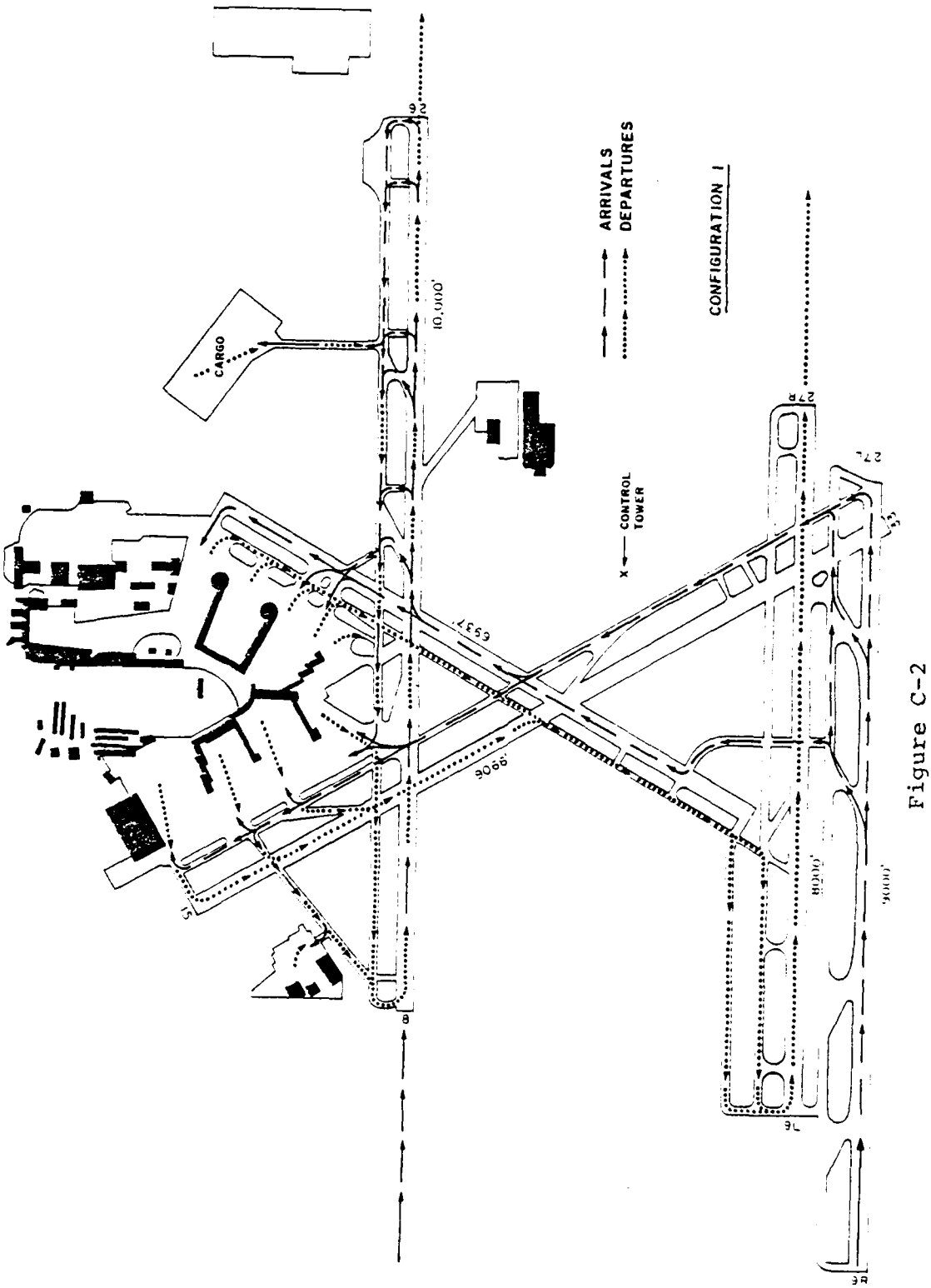
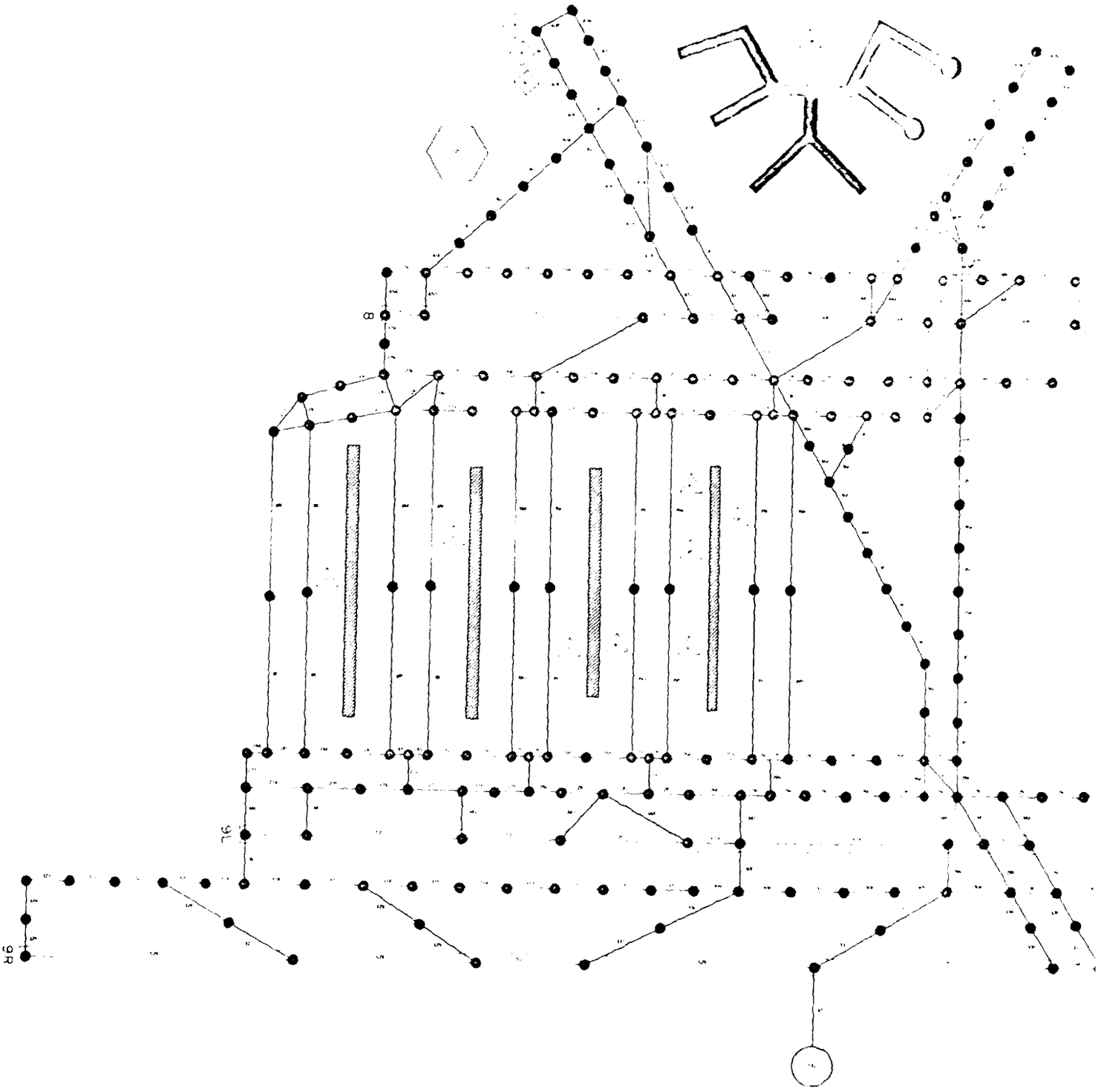


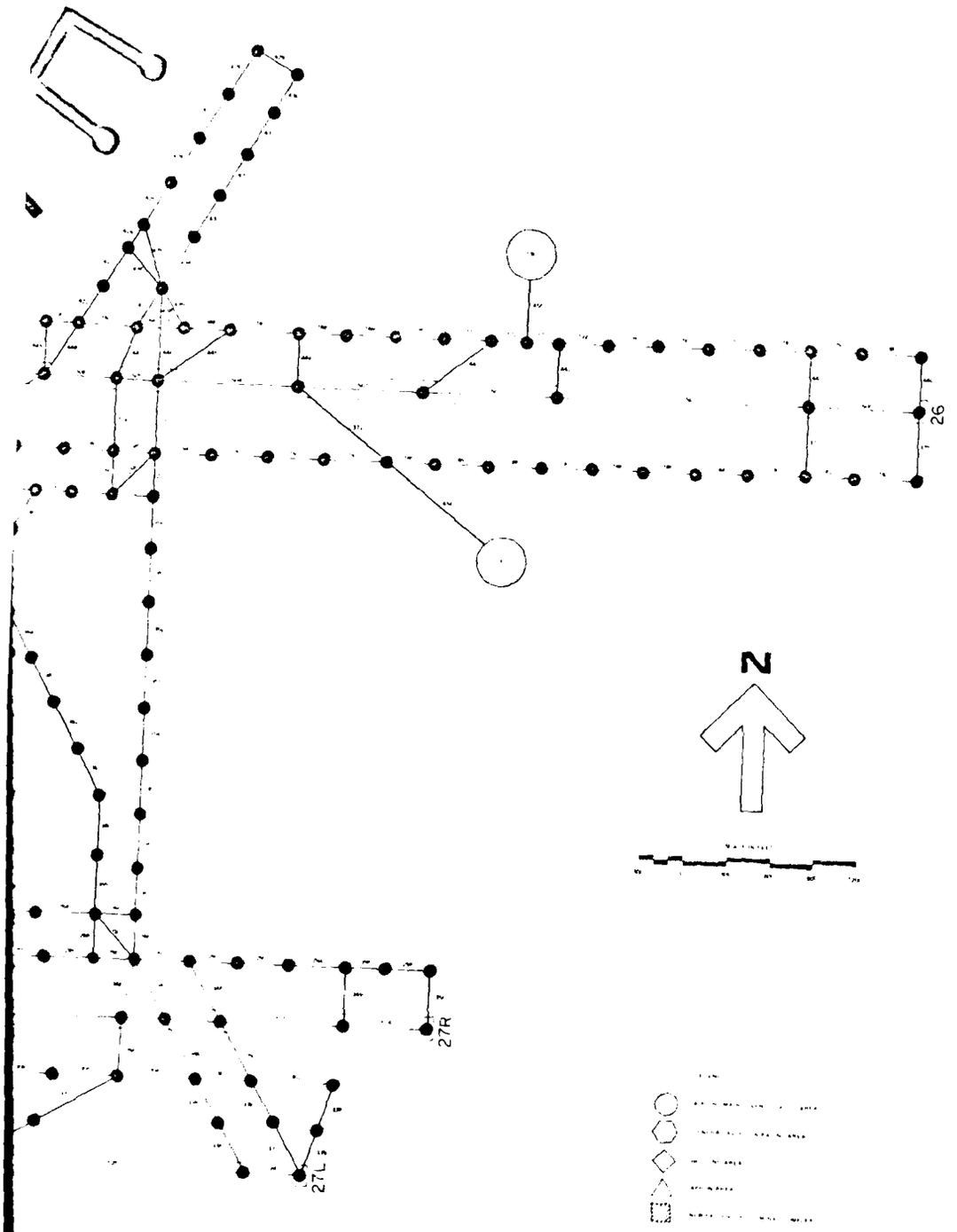
Figure C-2

TAXI ROUTES FOR 1978 SIMULATION RUNS



FUTURE AIRFIELD NETWORK

WILLIAM B. HARTSFIELD ATLANTA INTERNAT



ETWORK

INTERNATIONAL AIRPORT

Figure C-3

AIRFIELD NETWORK FOR 1982
SIMULATION RUNS

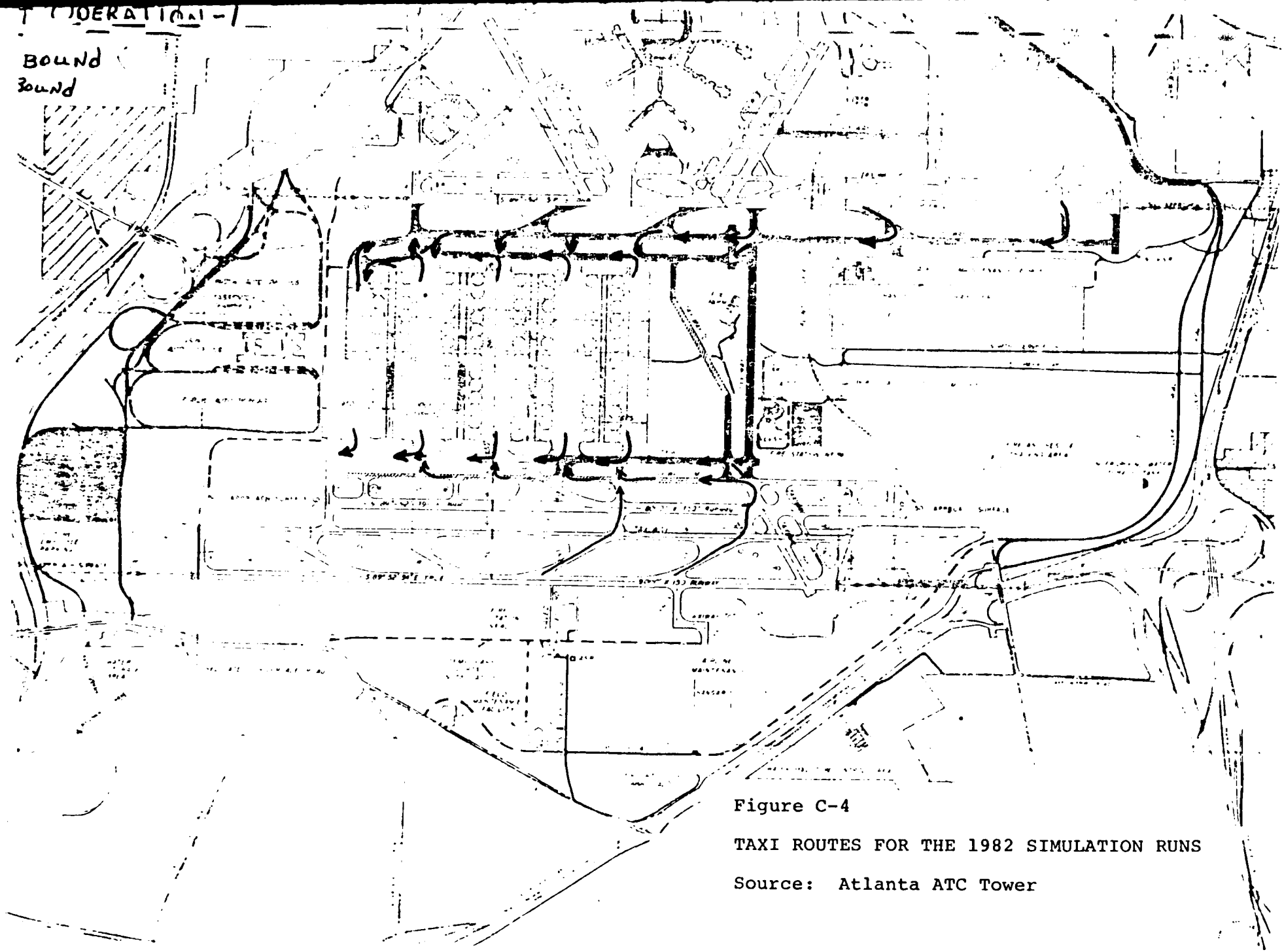
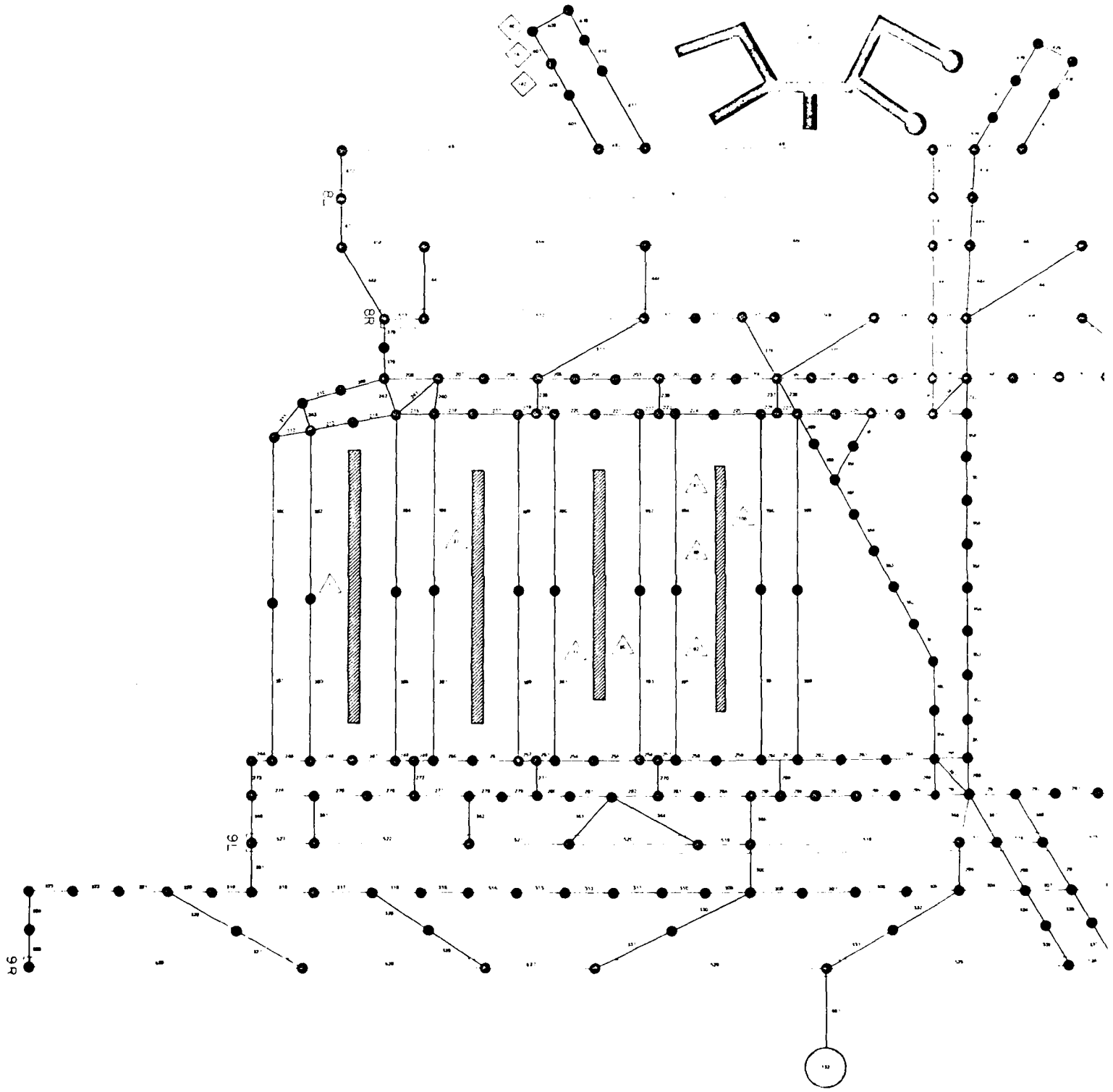


Figure C-4

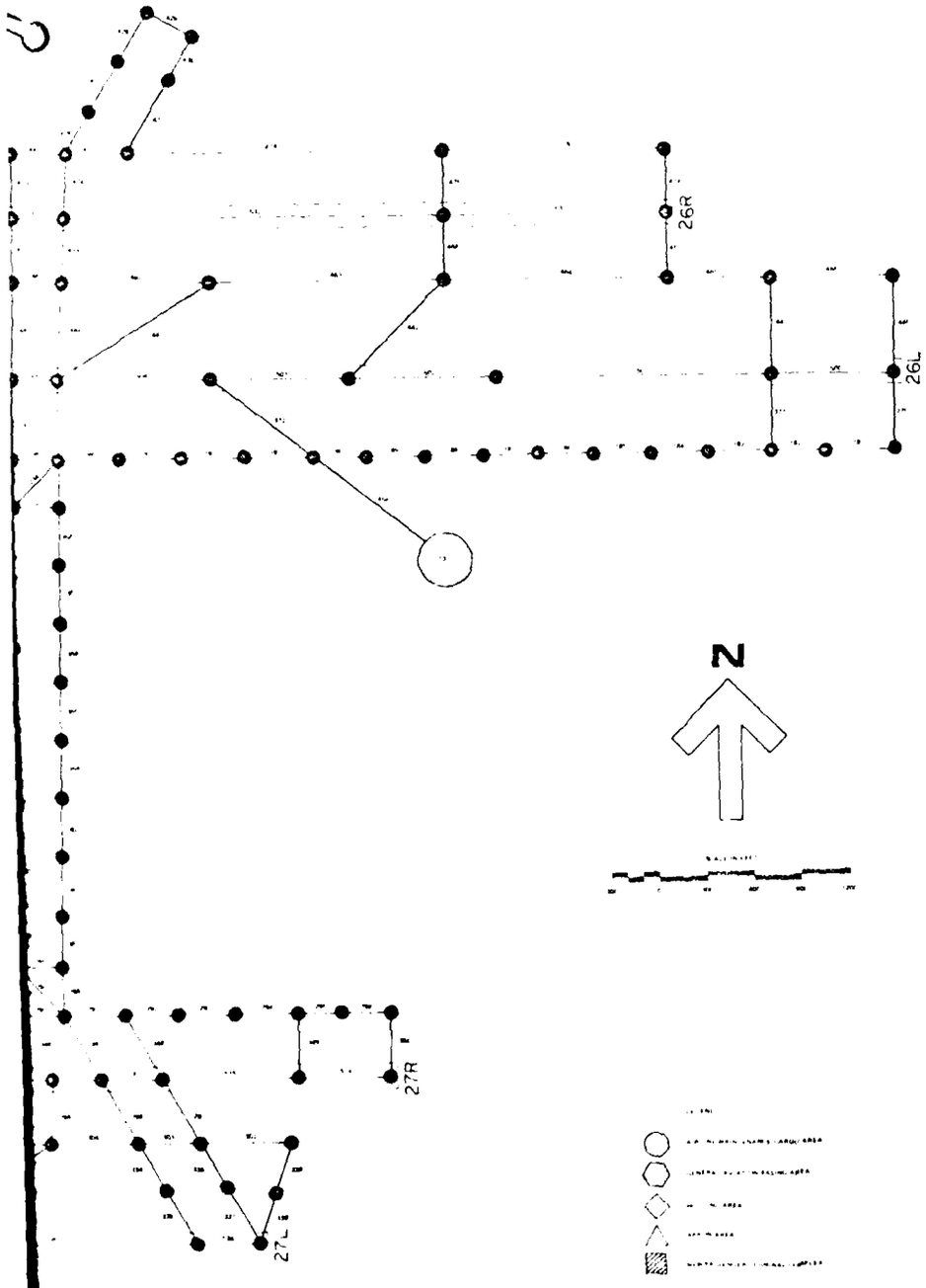
TAXI ROUTES FOR THE 1982 SIMULATION RUNS

Source: Atlanta ATC Tower



FUTURE AIRFIELD NETWORK

WILLIAM B. HARTSFIELD ATLANTA INTERNA



WORK

NTERNATIONAL AIRPORT

Figure C-5

AIRFIELD NETWORK FOR STAGE 2 SIMULATION RUNS FOR 1987 AND FOUR RUNWAYS

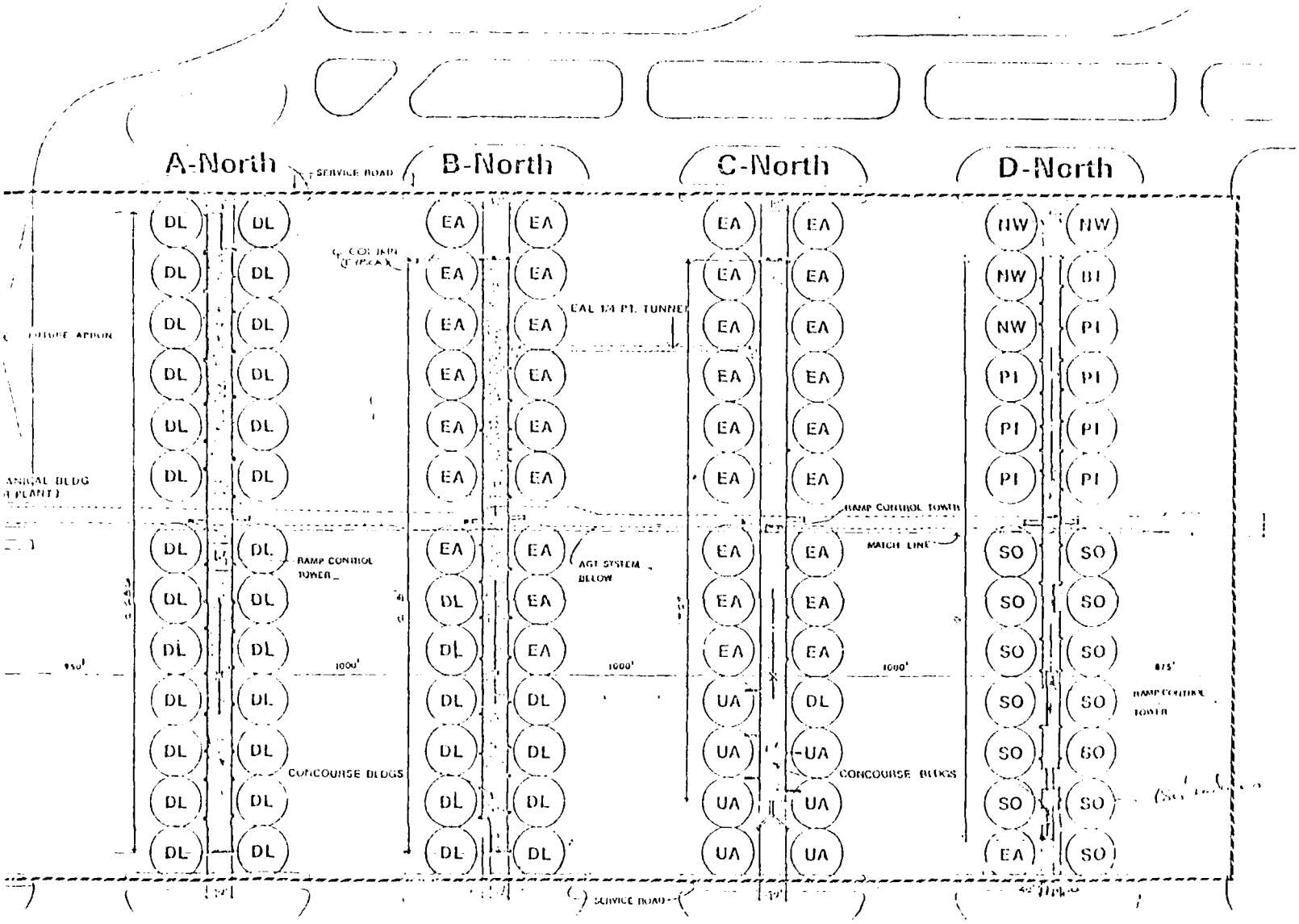


Figure C-6

Airline Gates for
New Terminal

Source: ATA

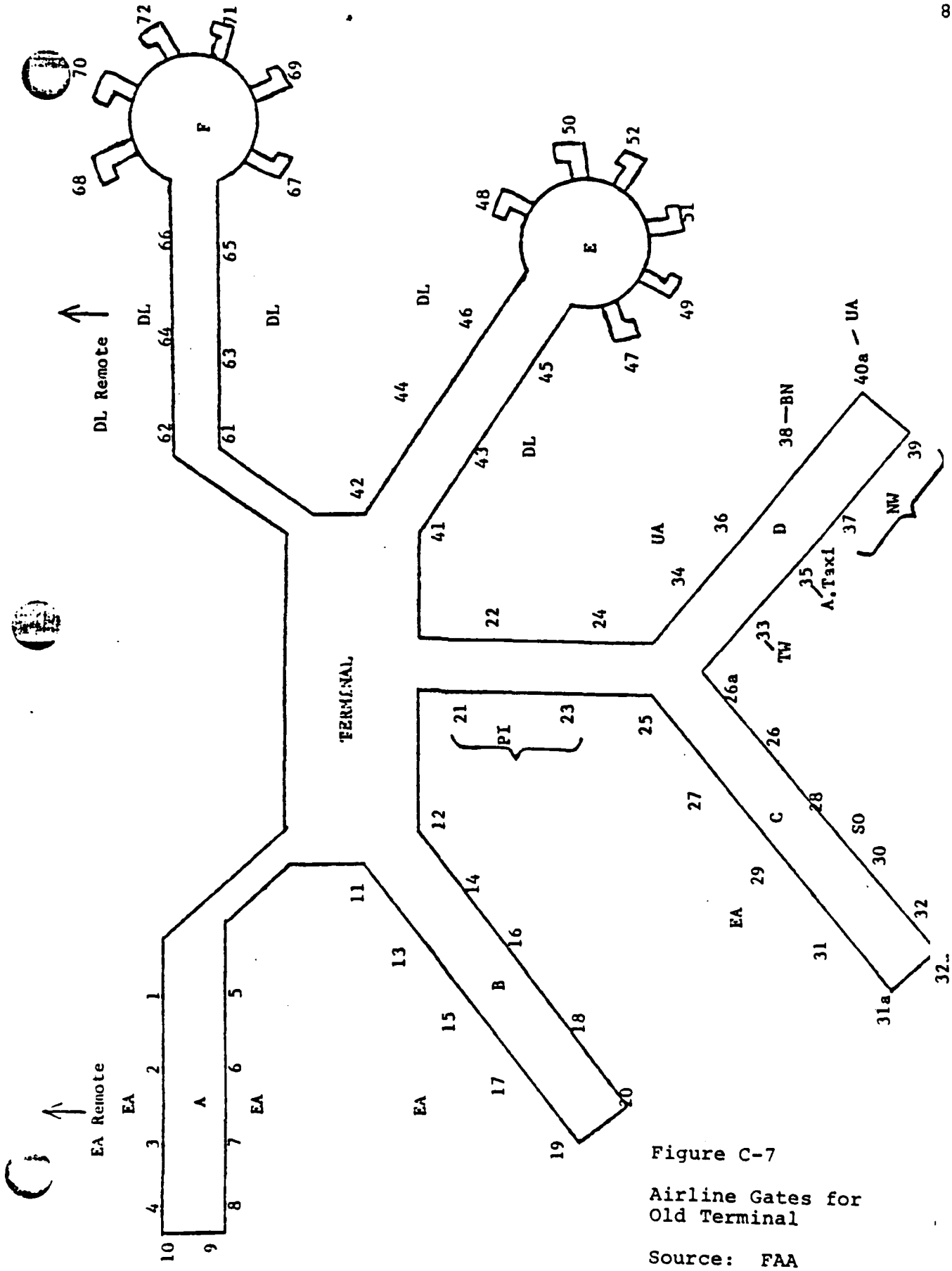


Figure C-7

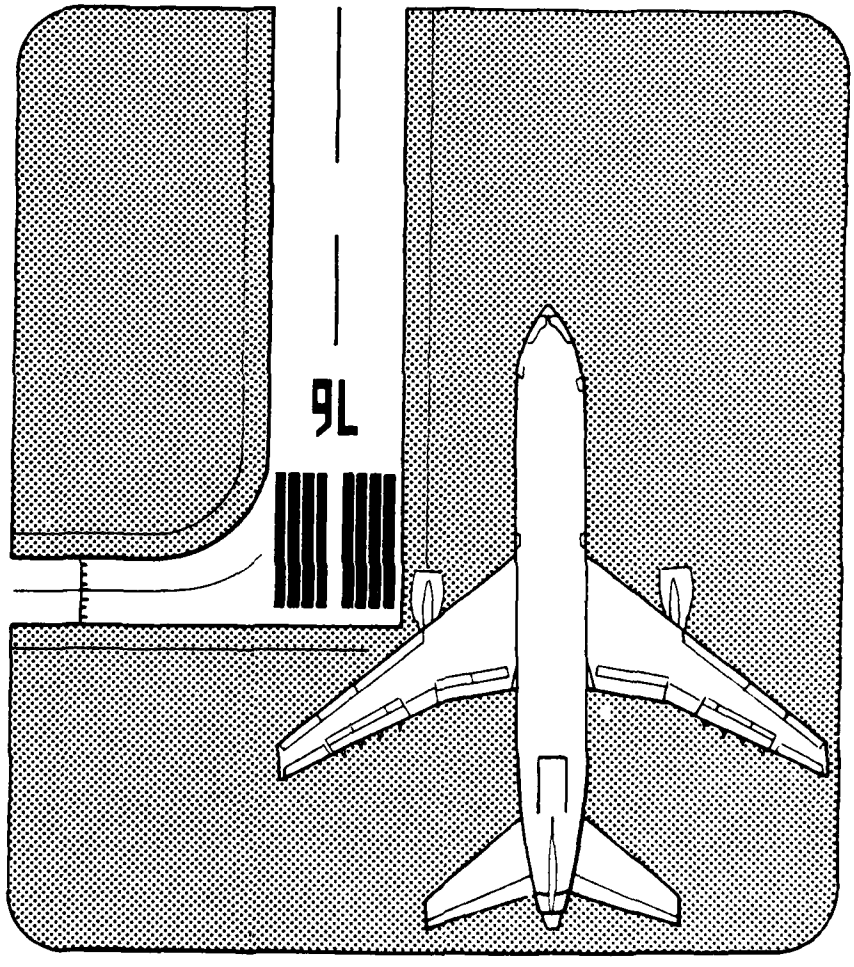
Airline Gates for Old Terminal

Source: FAA

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

DATA PACKAGE NO. 4

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES



prepared for

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

under contract

DOT FA77WA -3961

PMM&Co. Peat, Marwick, Mitchell & Co.

OCTOBER 1978

PEAT, MARWICK, MITCHELL & CO.
P. O. BOX 8007
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN FRANCISCO, CALIFORNIA 94128

Telephone: (415) 347-9521

October 24, 1978

Mr. Ray Fowler, AEM-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Re: Atlanta Data Package No. 4

Dear Ray:

Enclosed is Data Package No. 4 for William B. Hartsfield Atlanta International Airport. The package contains the results of the Stage-2 delay simulations (Attachment B) and results of four, revised Stage-1 delay simulations (Attachment A).

These data should be reviewed by the Atlanta Task Force during the 25 October 1978 Task Force meeting.

Sincerely,

Stephen L. M. Hockaday
Manager

SLMH/nbe
Enclosure

cc: Mr. J. R. Dupree, ALG-132
Mr. B. Drotts, ASO-4 (w/encl)

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES
Atlanta International Airport
Data Package No. 4

Table of Contents

Attachment A

RESULTS OF STAGE-1 DELAY SIMULATIONS
(Revised Experiments 1A, 2A, 1, and 2)

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

October 1978

Table A-1

ATLANTA TASK FORCE DELAY STUDIES
INDEX TO REVISED RESULTS
STAGE 1 EXPERIMENTS

Experiment No.	Model	Runways		Weather	Demand/ Improvement ATC	Page
		Arrivals	Departures			
1A	ASM	8, 9R	8, 9L	VFR1	1978	3
2A	ASM	8, 9R	8, 9L	IFR1	1978	6
1	ASM	8, 9R	8, 9L	VFR1	1982	9
2	ASM	8, 9R	8, 9L	IFR1	1982	12

EXPERIMENT NO. 1A

Objective:

To obtain 1978 baseline delay estimates in VFR1 weather for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment 2A has same demand and network but in IFR1 weather.

Length and Level of Detail of Simulation Run:

From 0800 to 2200 hours with 1-hour summaries.

Anticipated Results:

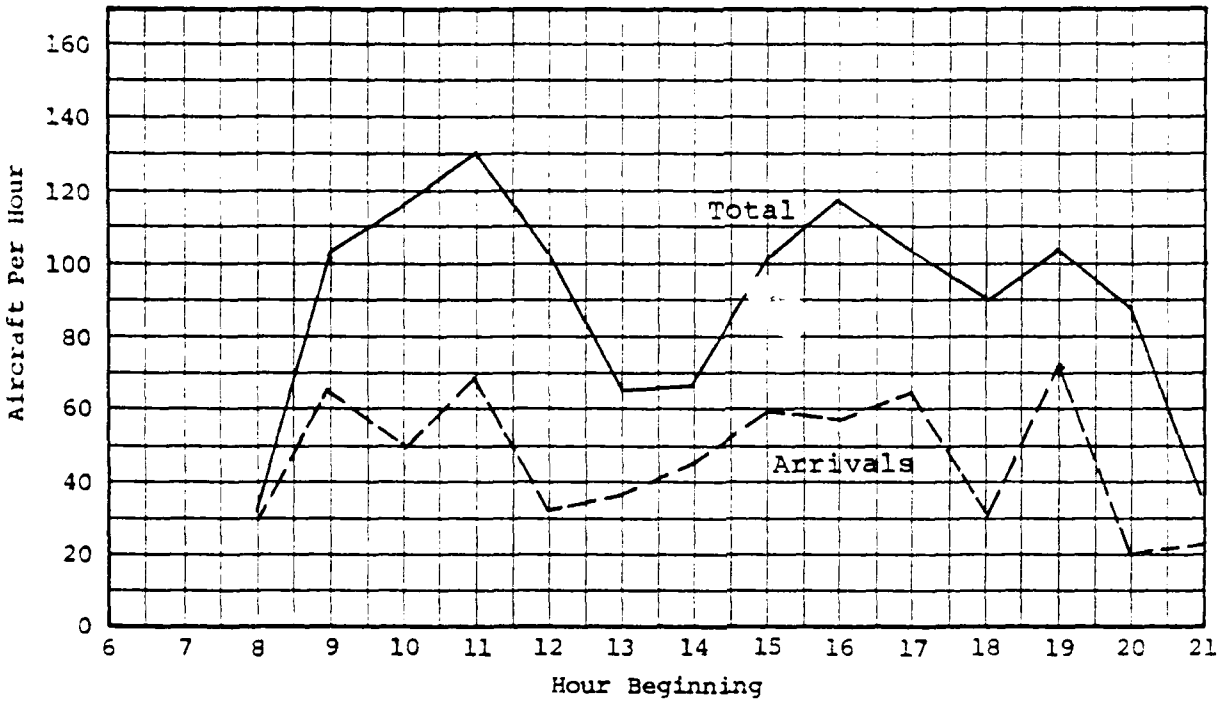
Lower delays than in Experiment 2A.

Summary Comparison: (See Figures 1A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	Peak*
Arrival	Flow Rate (a/c per hr.)	49.6	70
Arrival	Air Delay (min)	7.2	11.4
Arrival	Taxi-In Delay (min)		0.3
Arrival	R/W Crossing Delay (min)		0.2
Arrival	Gate Delay (min)		1.3
Departure	Flow Rate (a/c per hr.)	47.4	70
Departure	R/W Delay (min)	7.2	11.3
Departure	Taxi-Out Delay (min)		0.6
Departure	R/W Crossing Delay (min)		0.3
Departure	Gate Delay (min)		2.1

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE (1A)A AVERAGE RUNWAY FLOW RATES



FIGURE(1A)B AVERAGE RUNWAY DELAYS

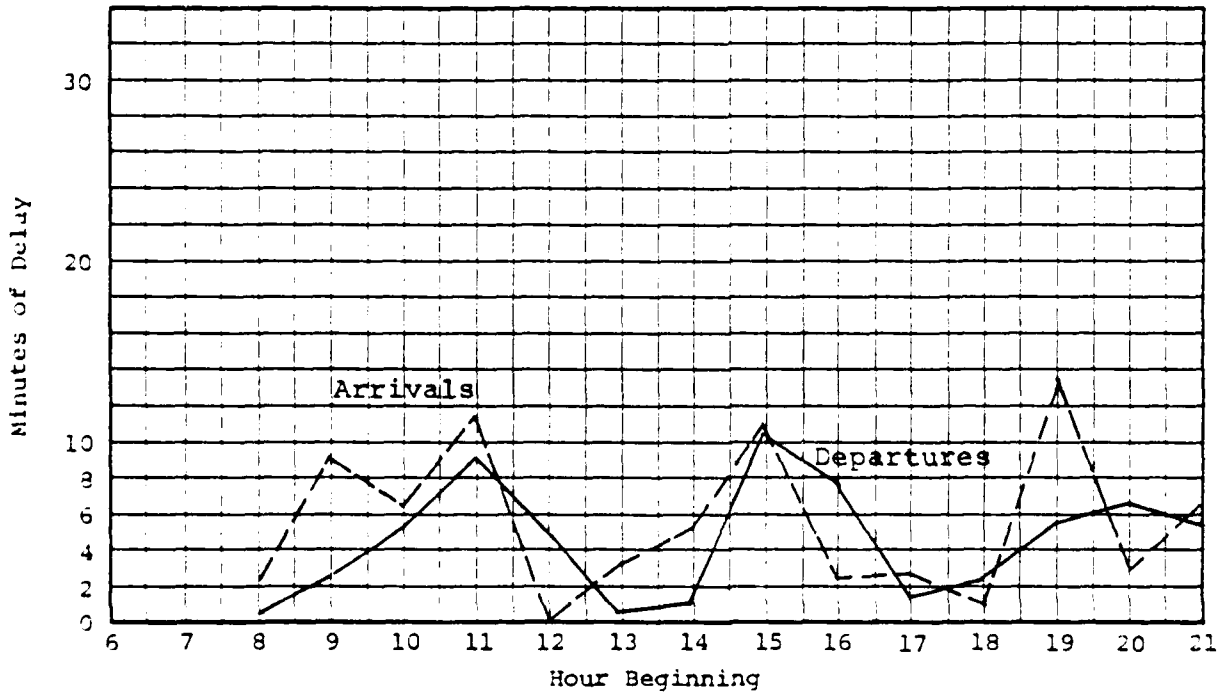


FIGURE (1A) C AVERAGE TAXIWAY DELAYS

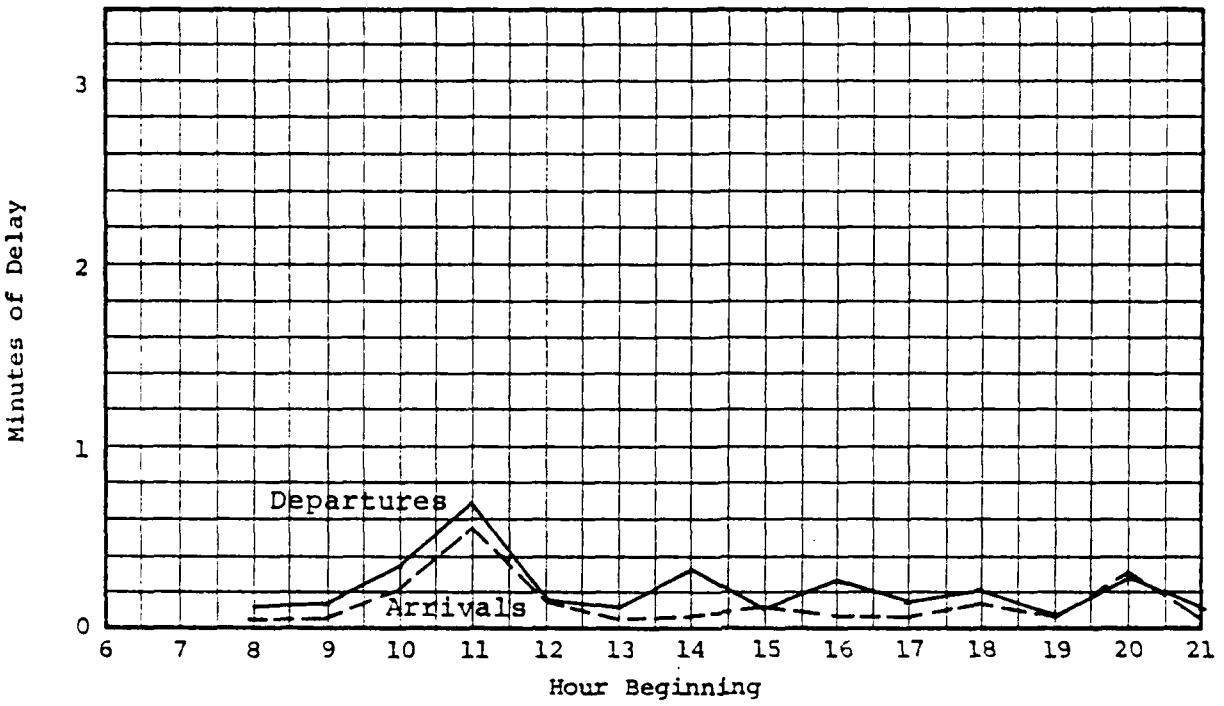
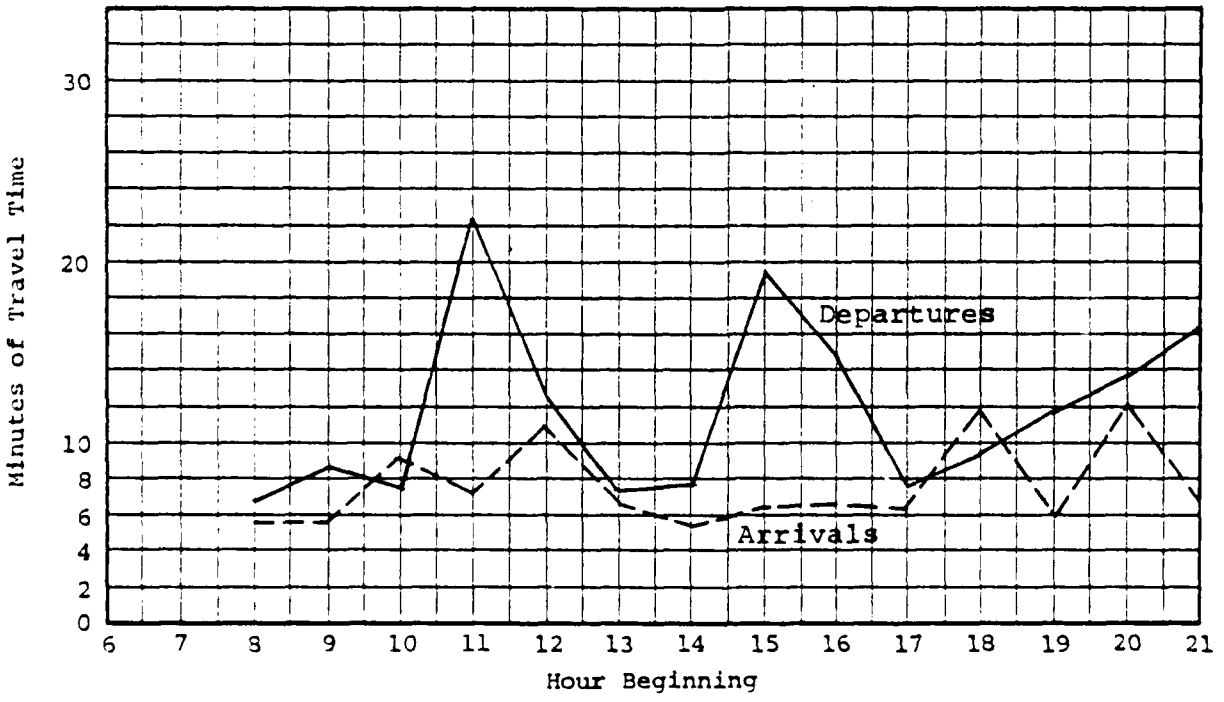


FIGURE (1A) D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 2A

Objective:

To obtain 1978 baseline delay estimates in IFR1 weather for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment 1A has same demand and network but in VFR1 weather.

Length and Level of Detail of Simulation Run:

From 0800 to 1300 hours with 1-hour summaries.

Anticipated Results:

Higher delays than in Experiment 1A.

Summary Comparison: (See Figures 2A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*
Arrival	Flow Rate (a/c per hr.)	47.8	54
Arrival	Air Delay (min)	23.5	42.8
Arrival	Taxi-In Delay (min)		5.9
Arrival	R/W Crossing Delay (min)		0.2
Arrival	Gate Delay (min)		2.5
Departure	Flow Rate (a/c per hr.)	41.4	58
Departure	R/W Delay (min)	13.6	23.8
Departure	Taxi-Out Delay (min)		4.5
Departure	R/W Crossing Delay (min)		0.2
Departure	Gate Delay (min)		42.1

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE (2A) A AVERAGE RUNWAY FLOW RATES

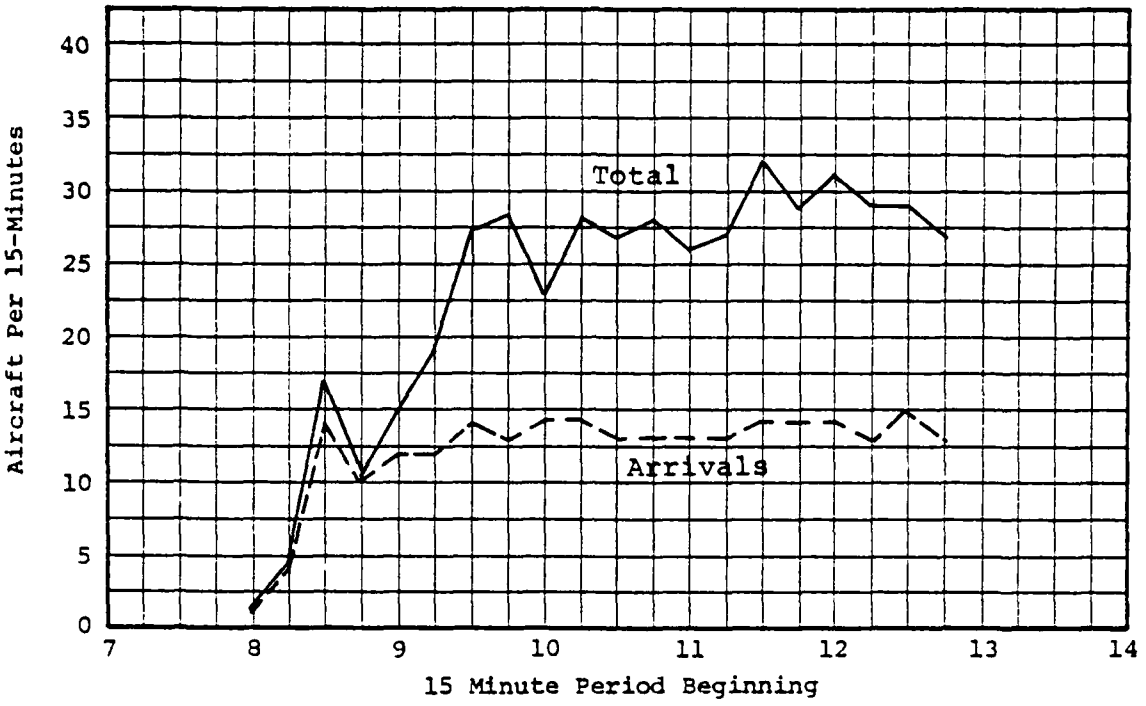


FIGURE (2A) B AVERAGE RUNWAY DELAYS

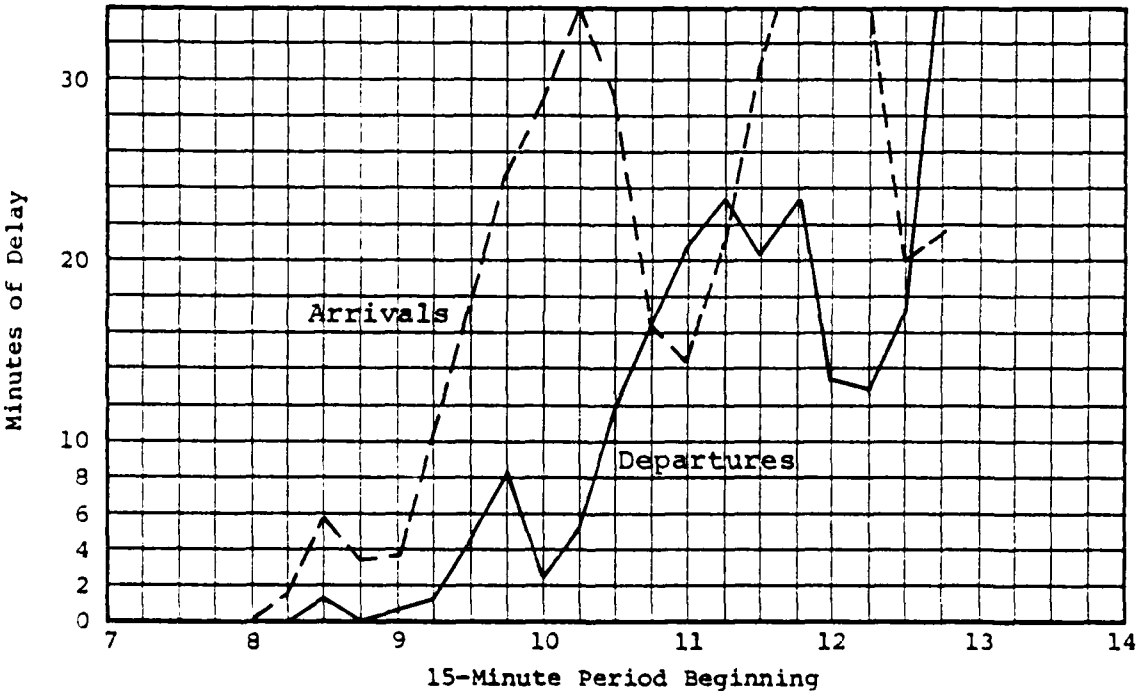


FIGURE (2A)C AVERAGE TAXIWAY DELAYS

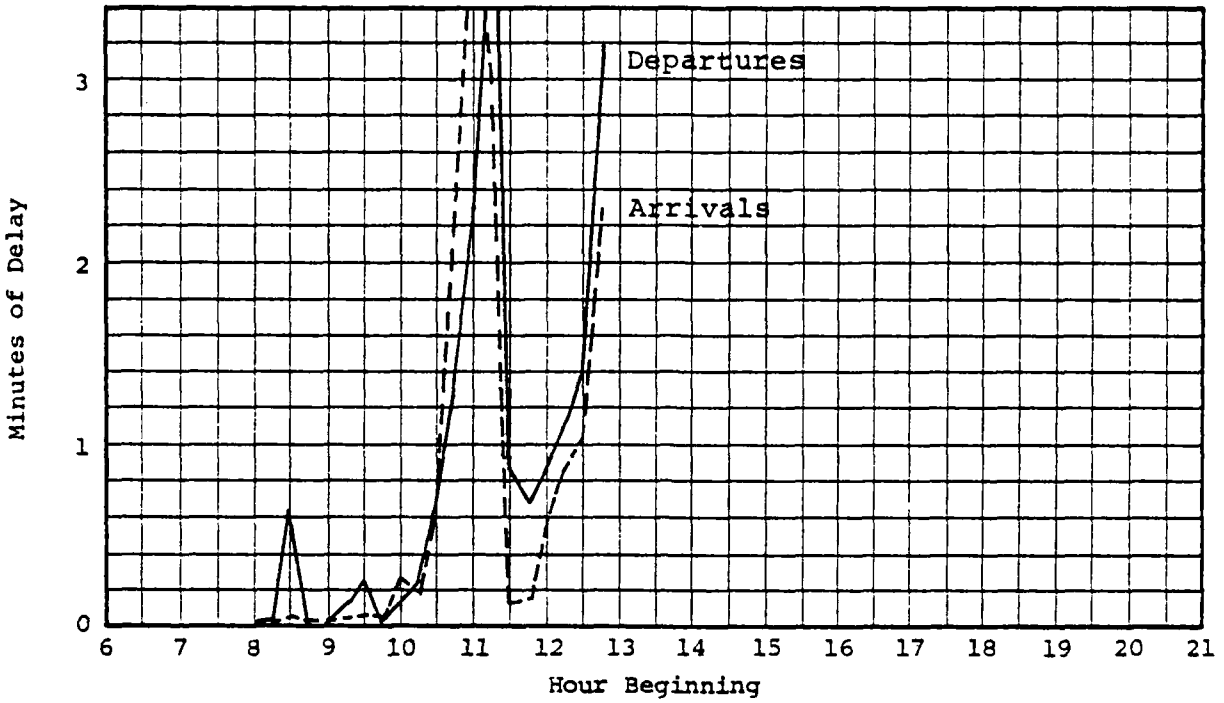
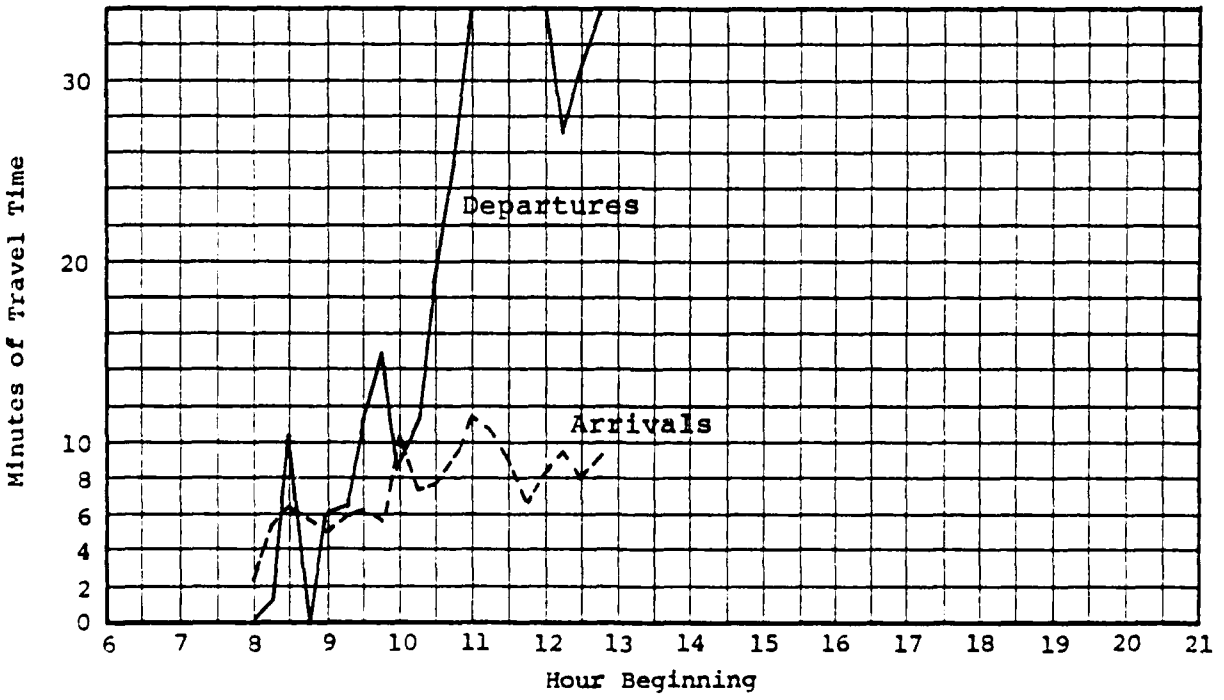


FIGURE (2A)D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 1

Objective:

To obtain delay estimates in VFR1 weather with the new Midfield Terminal, 1982 demand, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared with Experiment No. 1A, which was for the old terminal and 1978 demand and ATC separations in VFR1 weather.

Length and Level of Detail of Simulation Run:

From 0800 to 2200 hours with 1-hour summaries

Summary Comparison: (See Figures 1A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*	Experiment No. 1A Daily*	Experiment No. 1A Peak*
Arrival	Flow Rate (a/c per hr.)	53.0	76	49.6	70
Arrival	Air Delay (min)	6.1	10.9	7.2	11.4
Arrival	Taxi-In Delay (min)		0.0		0.3
Arrival	R/W Crossing Delay (min)		0.2		0.2
Arrival	Gate Delay (min)		0.1		1.3
Departure	Flow Rate (a/c per hr.)	51.0	77	47.4	70
Departure	R/W Delay (min)	6.6	8.0	7.2	11.3
Departure	Taxi-Out Delay (min)		1.0		0.6
Departure	R/W Crossing Delay (min)		0.0		0.3
Departure	Gate Delay (min)		2.3		2.1

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 1A AVERAGE RUNWAY FLOW RATES

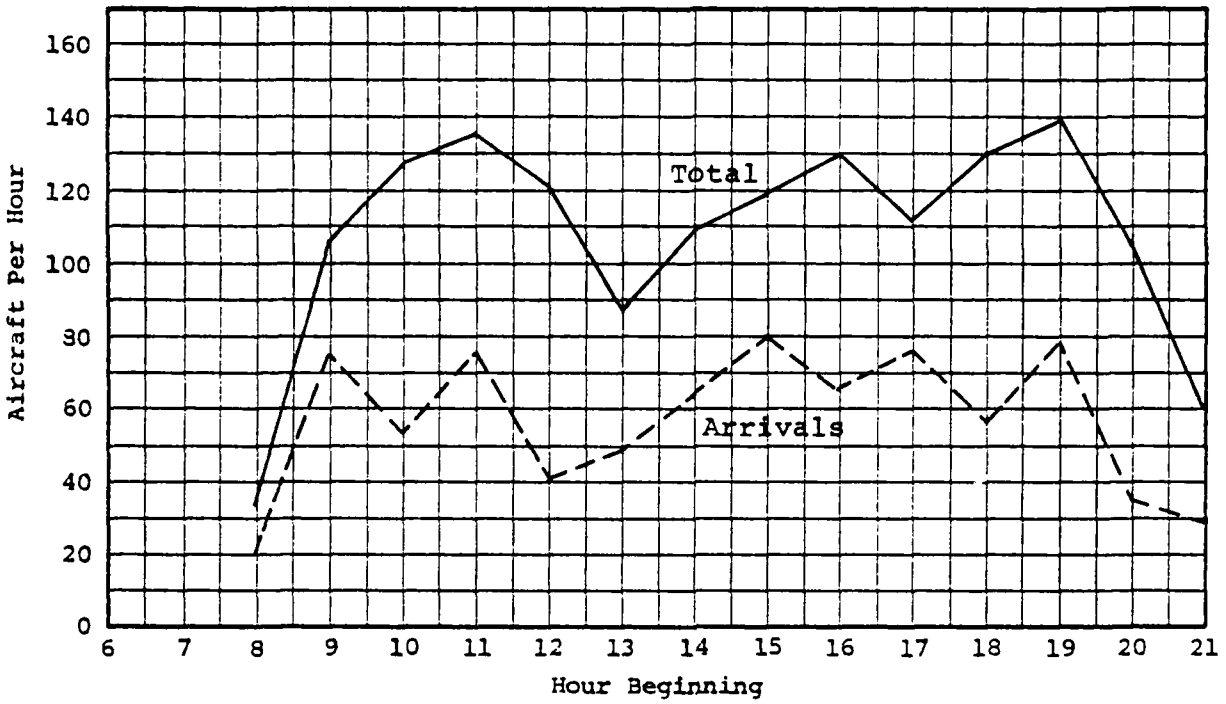


FIGURE 1B AVERAGE RUNWAY DELAYS

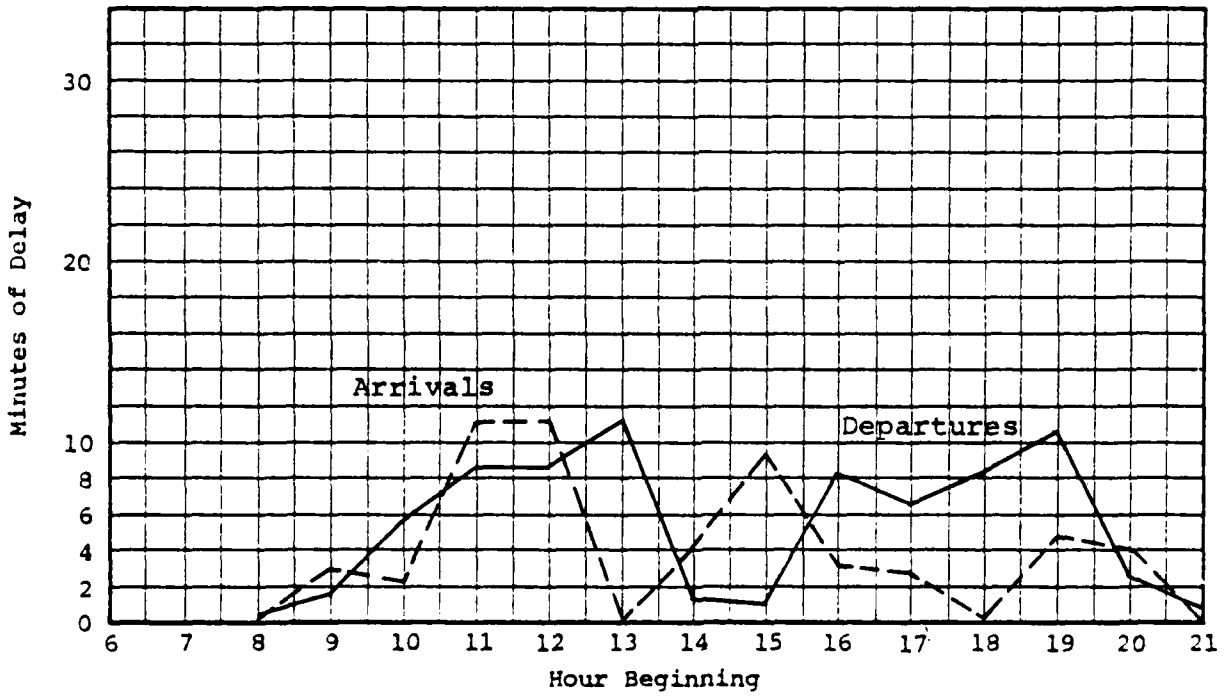


FIGURE 1C AVERAGE TAXIWAY DELAYS

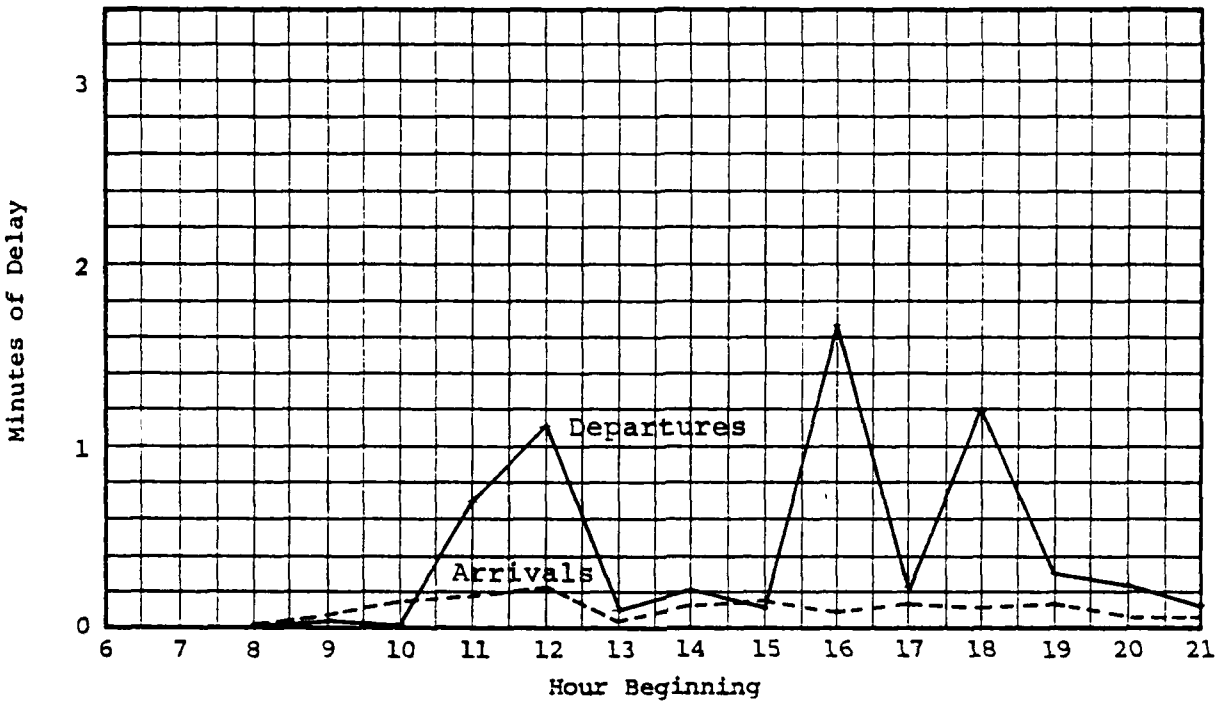
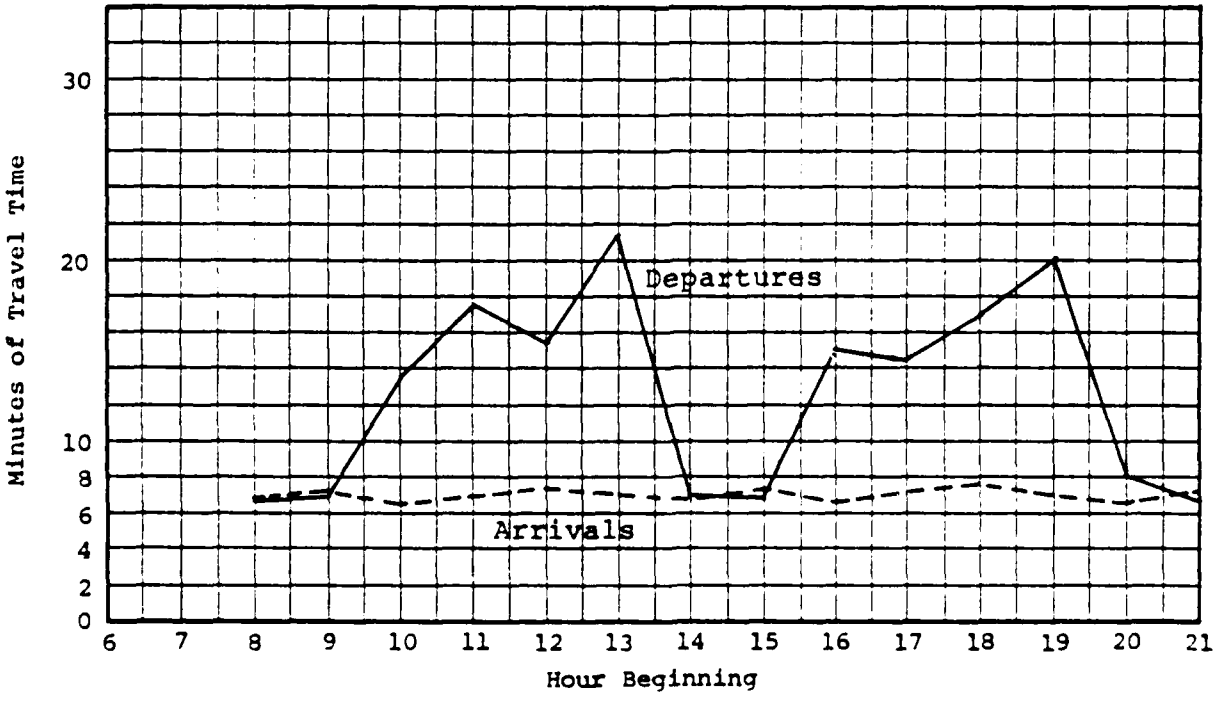


FIGURE 1D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 2

Objective:

To obtain delay estimates in IFR1 weather with the Midfield Terminal, 1982 demand, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared to Experiment No. 2A to examine differences due to the new demand, ATC separations, and terminal building compared to today's IFR1 conditions. It can also be compared to Experiment No. 1 to examine differences between 1982 VFR1 and IFR1.

Length and Level of Detail of Simulation Run:

From 0800 to 2200 hours with 15-minute summaries.

Summary Comparison: (See Figures 2A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*	Experiment No. 2A Daily*	Experiment No. 2A Peak*
Arrival	Flow Rate (a/c per hr.)	56.4	62	47.2	54
Arrival	Air Delay (min)	17.7	32.5	23.5	42.8
Arrival	Taxi-In Delay (min)		0.2		5.9
Arrival	R/W Crossing Delay (min)		0.7		0.2
Arrival	Gate Delay (min)		0.0		2.5
Departure	Flow Rate (a/c per hr.)	49.2	62	41.4	58
Departure	R/W Delay (min)	12.6	19.4	13.6	23.8
Departure	Taxi-Out Delay (min)		5.5		4.5
Departure	R/W Crossing Delay (min)		0.0		0.2
Departure	Gate Delay (min)		141.4		42.1

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 2A AVERAGE RUNWAY FLOW RATES

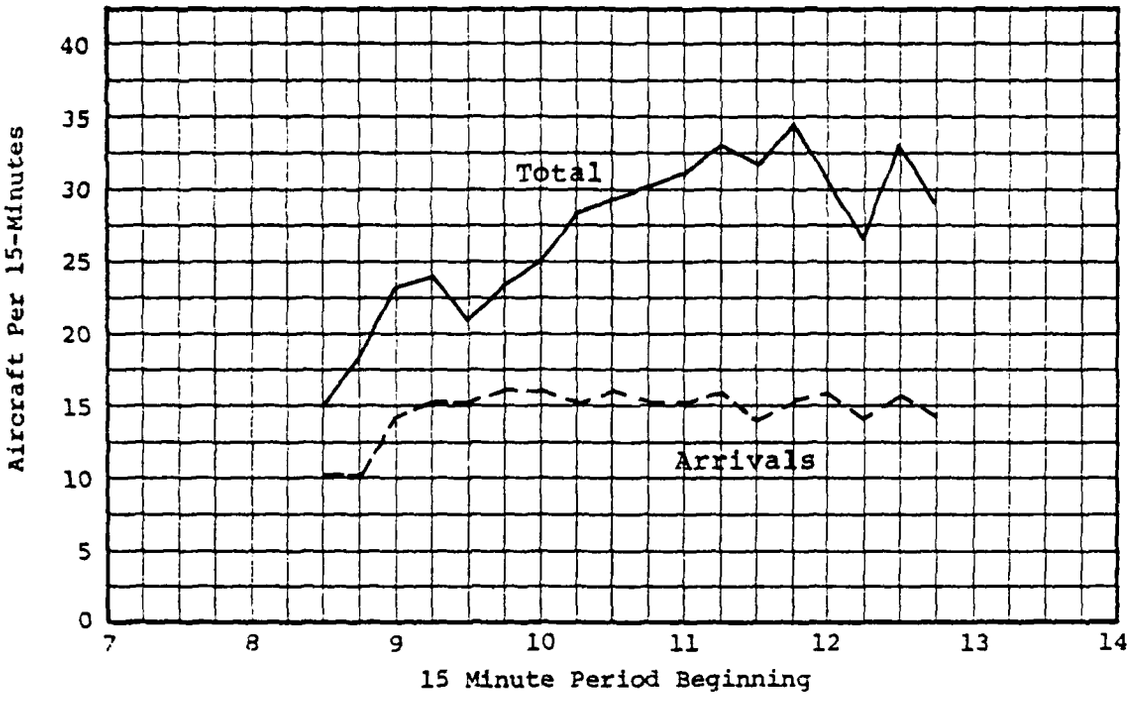


FIGURE 2B AVERAGE RUNWAY DELAYS

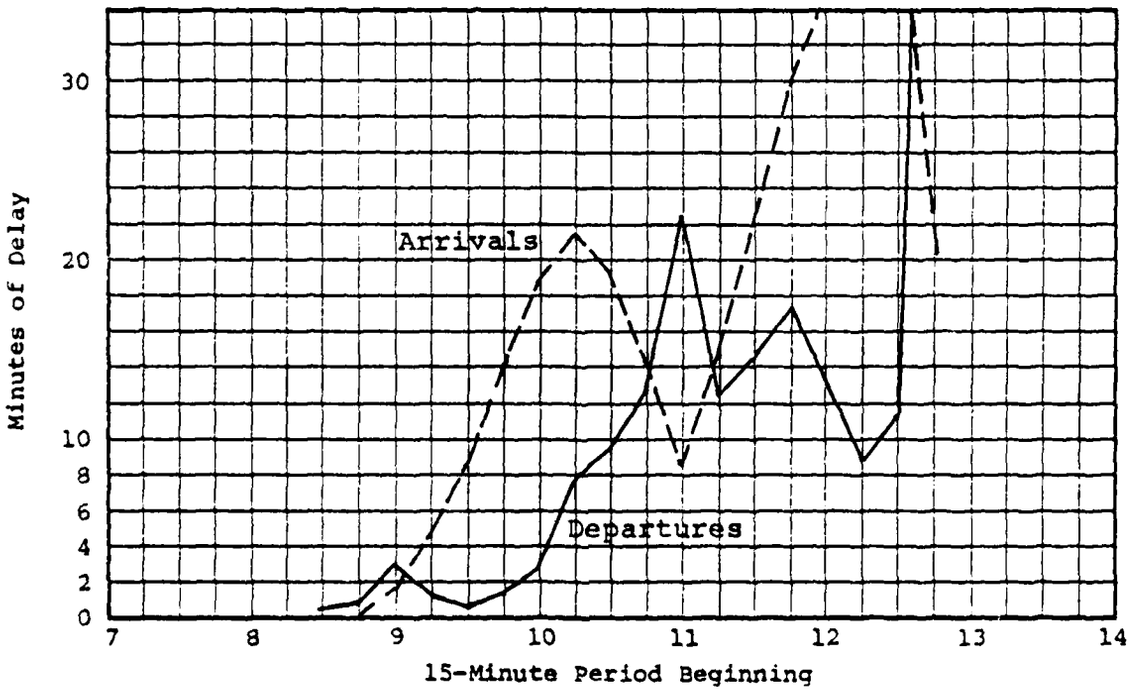


FIGURE 2C AVERAGE TAXIWAY DELAYS

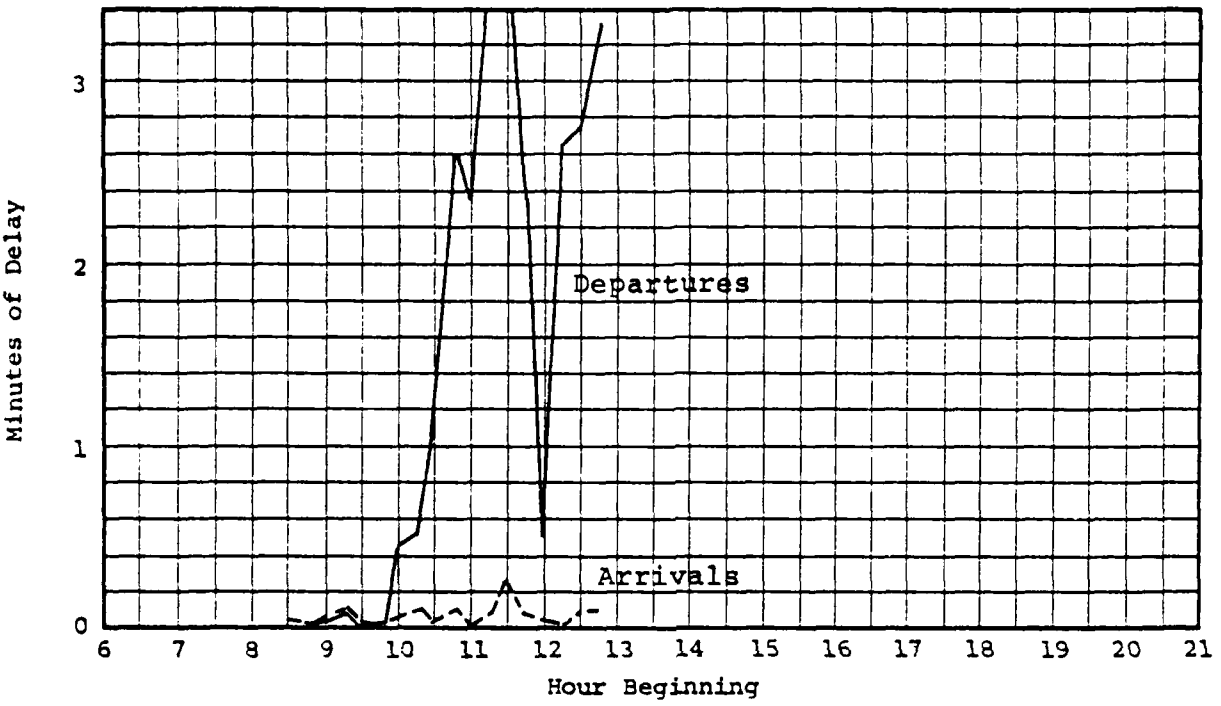
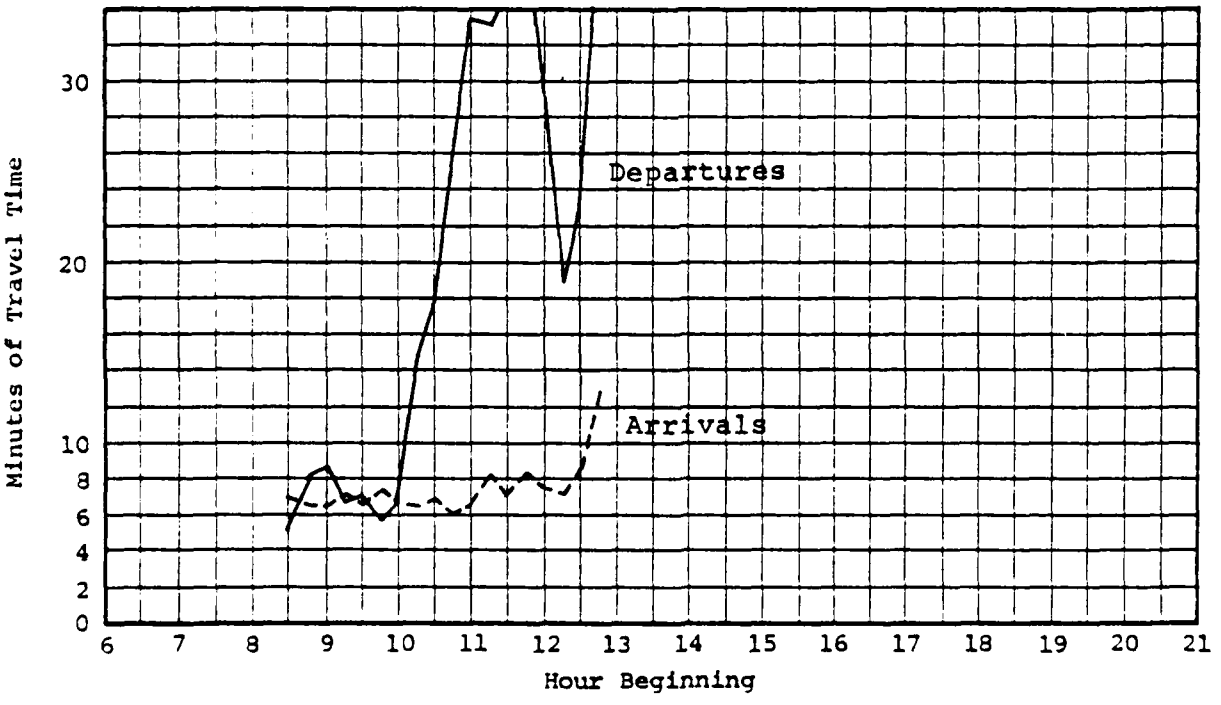


FIGURE 2D AVERAGE TAXIWAY TRAVEL TIMES



Attachment B

RESULTS OF STAGE-2 DELAY SIMULATIONS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

October 1978

Table B-1

ATLANTA TASK FORCE DELAY STUDIES
REVISED STAGE-2 EXPERIMENTS

Experiment No.	Model	Study Case	Arrival Runways	Departure Runways	Weather	Demand	ATC System Scenario	Near-Term Improvements	Comments
13	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	Pre-1985	Midfield
14	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	None	Old terminal
15	ADM	n.a.	n.a.	n.a.	n.a.	1982	Today's	Pre-1985	Midfield
16	ADM	n.a.	n.a.	n.a.	n.a.	1982	Today's	None	Old terminal
17	ASM	12	8R, 9L	8L, 9R	IFR1	1982	1982	8L/26R	Inboard arrivals
18	ASM	13	8L, 9R	8R, 9L	IFR1	1982	1982	8L/26R	Outboard arrivals
19	ASM	5	8, 9R	8, 9L	IFR1	1987	1987	Pre-1985	Midfield
20	ASM	5	8L, 9R	8R, 9L	IFR1	1987	1987	8L/26R	4th R/W
21	ASM	5	8L, 9R	8R, 9L	VFR1	1987	1987	8L/26R	4th R/W-VFR1
22	ASM	5	8, 9R	8, 9L	IFR1	1982	1982	No gate hold	Unconstrained
23	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	6 mo.-3 R/W's 6 mo.-2 R/W's (no 8-26)	Cancellation Limit = 1 hr.
24	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	Post-1985	4 R/W's
25	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	None	3 R/W's
26	ADM	n.a.	n.a.	n.a.	n.a.	1987	Today's	Post-1985	4 R/W's
27	ADM	n.a.	n.a.	n.a.	n.a.	1987	Today's	None	3 R/W's
28	ASM	5	8, 9R	8, 9L	IFR1	1978	Today's	2 departure tracks on runway 9L	Eliminates single departure track out 4 nautical miles on Runway 9L only.

n.a. = not applicable.

Table B-2

ATLANTA TASK FORCE DELAY STUDIES
ORGANIZATION OF STAGE-2
AIRFIELD SIMULATION MODEL EXPERIMENTS
AND
INDEX TO STAGE-2 RESULTS

Sequence No.	Experiment No.*	Model	Runways		Weather	Demand	ATC	Improvement	Index: Page
			Arrivals	Departures					
1	28	ASM	8, 9R	8, 9L	IFR1	1978	Today's	Existing	18
2	22	ASM	8, 9R	8, 9L	IFR1	1982	Near	Pre-1985	21
3	17	ASM	8R, 9L	8L, 9R	IFR1	1982	Near	Pre-1985	24
4	18	ASM	8L, 9R	8R, 9L	IFR1	1982	Near	Pre-1985	27
5	19	ASM	8, 9R	8, 9L	IFR1	1987	Far	Pre-1985	30
6	20	ASM	8L, 9R	8R, 9L	IFR1	1987	Far	Post-1985	33
7	21	ASM	8L, 9R	8R, 9L	VFR1	1987	Far	Post-1985	36

*Refers to numbers agreed to at Atlanta Task Force Meeting No. 4, July 12, 1978, the Subgroup Meeting of August 25, 1978, and the changes identified on September 25, 1978 at the fifth Task Force Meeting.

EXPERIMENT NO. 28

Objective:

To obtain 1978 delay estimates assuming that there are two departure tracks on Runway 9L, i.e., no environmental constraints on 9L, for the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Results of this experiment can be compared to the results of Experiment No. 2A of Stage 1 to evaluate benefits of relieving single departure track constraint.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Anticipated Results:

Lower departure delays than in Experiment 2A.

Summary Comparison: (See Figures 28A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*	Experiment No. 2A Daily*	Experiment No. 2A Peak*
Arrival	Flow Rate (a/c per hr.)	47.6	54	47.8	54
Arrival	Air Delay (min)	23.9	42.7	23.5	42.8
Arrival	Taxi-In Delay (min)		7.4		5.9
Arrival	R/W Crossing Delay (min)		0.2		0.2
Arrival	Gate Delay (min)		2.4		2.5
Departure	Flow Rate (a/c per hr.)	40.4	56	41.4	58
Departure	R/W Delay (min)	13.3	22.3	13.6	23.8
Departure	Taxi-Out Delay (min)		8.5		4.5
Departure	R/W Crossing Delay (min)		0.2		0.2
Departure	Gate Delay (min)		36.7		42.1

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 28A AVERAGE RUNWAY FLOW RATES

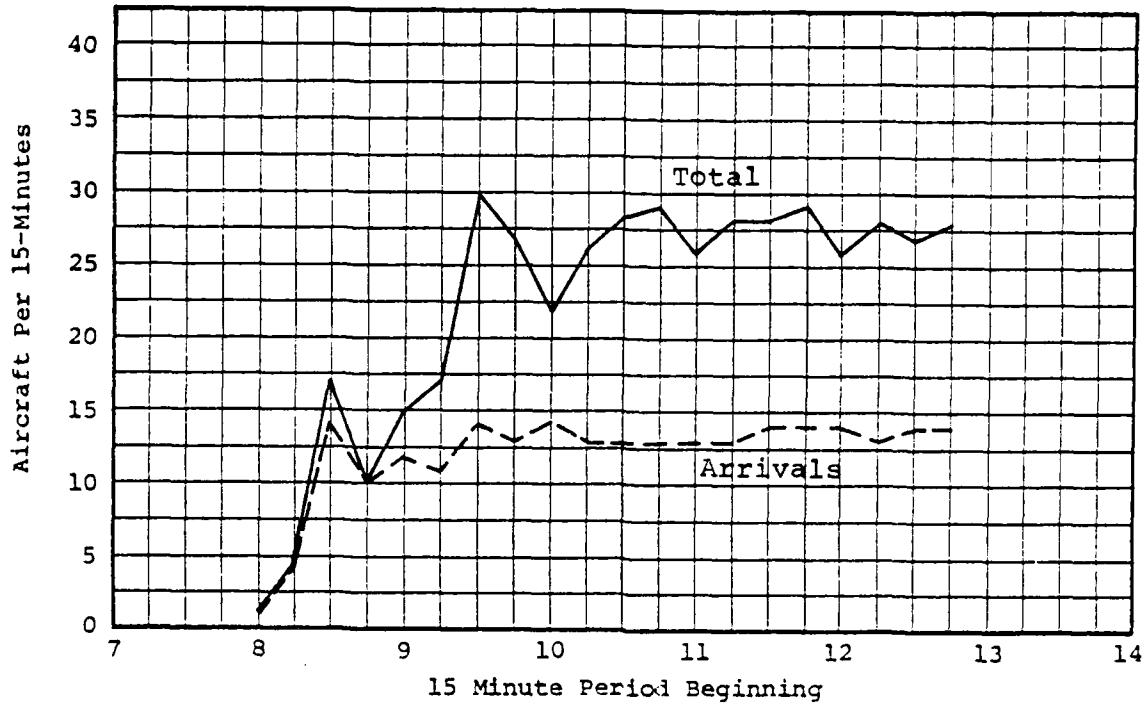


FIGURE 28B AVERAGE RUNWAY DELAYS

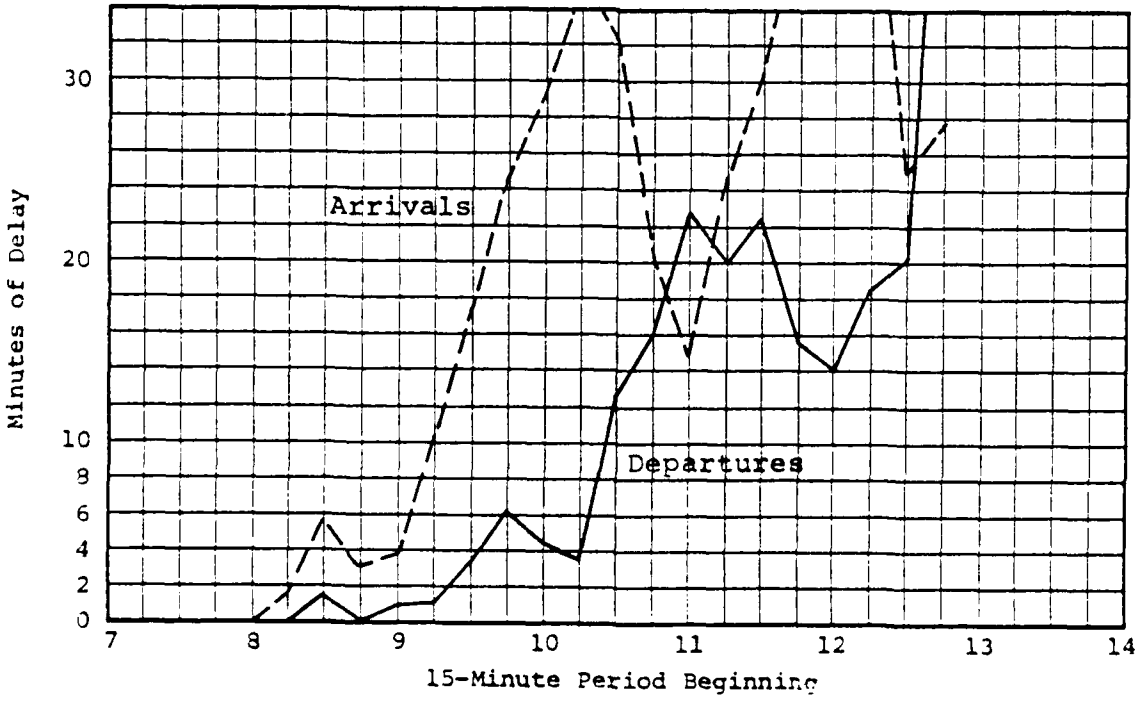


FIGURE 28C AVERAGE TAXIWAY DELAYS

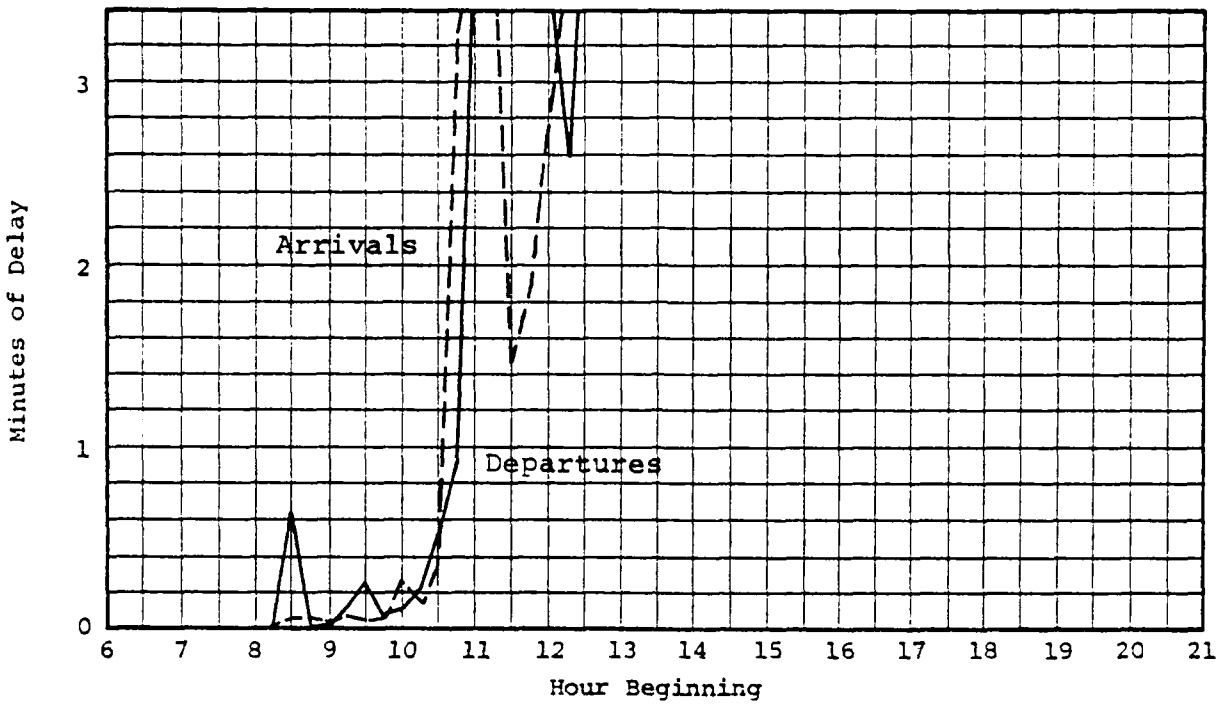
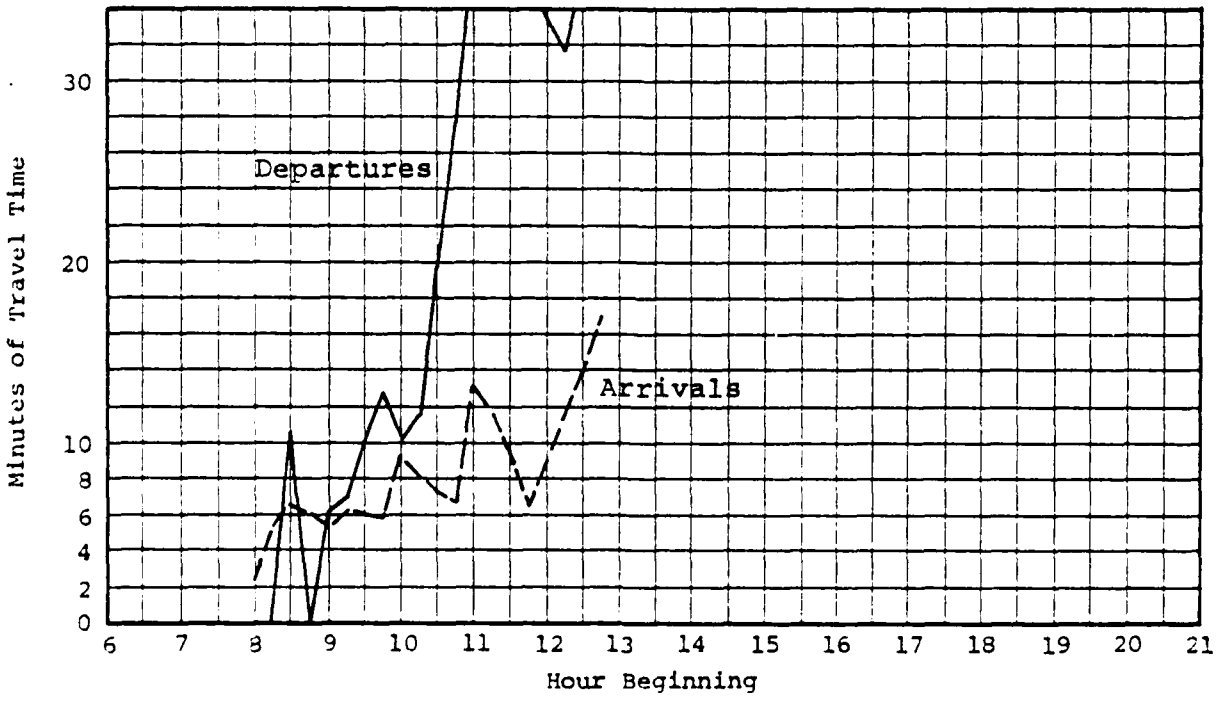


FIGURE 28D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 22

Objective:

To obtain delay estimates for the case where there are no gate holds in 1982 at Midfield Terminal with near-term ATC separations and the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment No. 2 estimates the delays associated with an assumed gate-hold procedure where aircraft are held at the gates when the length of departure queue reaches 10 aircraft.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Anticipated Results:

Reduced arrival and departure gate delays compared to Experiment 2.

Summary Comparison: (See Figures 22A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*	Experiment No. 2 Daily*	Experiment No. 2 Peak*
Arrival	Flow Rate (a/c per hr.)	56.5	62	56.4	62
Arrival	Air Delay (min)	18.0	43.8	17.7	32.5
Arrival	Taxi-In Delay (min)		0.02		0.2
Arrival	R/W Crossing Delay (min)		0.2		0.7
Arrival	Gate Delay (min)		0.0		0.0
Departure	Flow Rate (a/c per hr.)	46.2	60	49.2	62
Departure	R/W Delay (min)	14.5	31.8	12.6	19.4
Departure	Taxi-Out Delay (min)		0.5		5.5
Departure	R/W Crossing Delay (min)		0.0		0.0
Departure	Gate Delay (min)		0.0		141.4

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 22A AVERAGE RUNWAY FLOW RATES

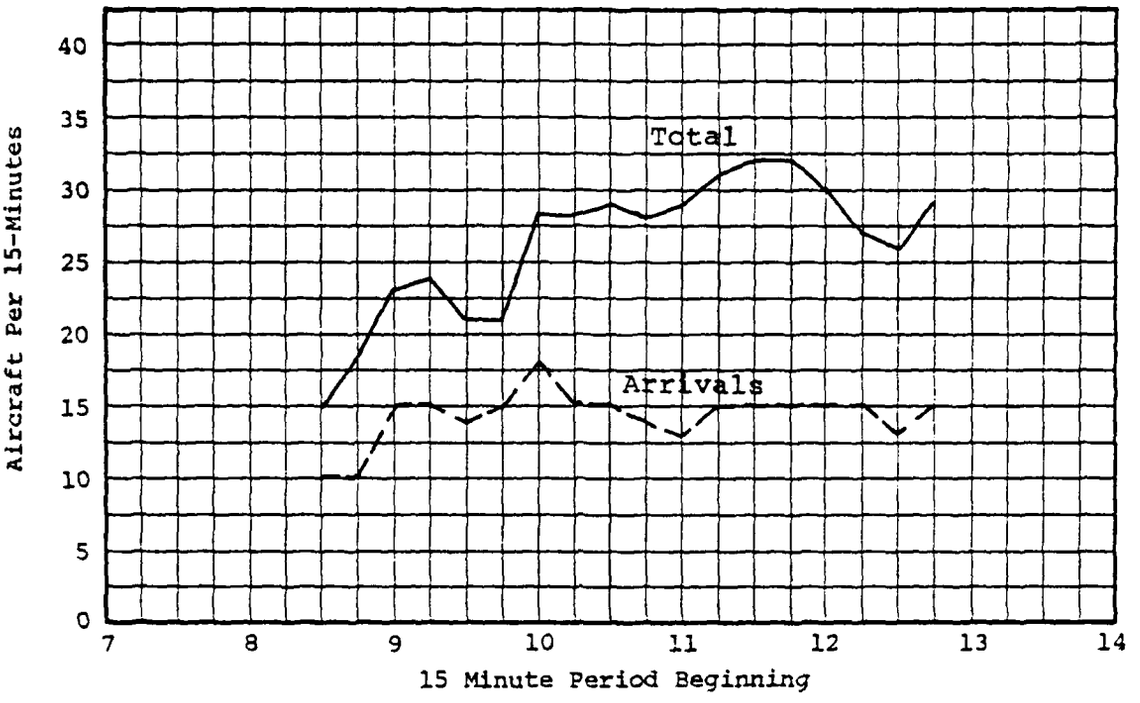


FIGURE 22B AVERAGE RUNWAY DELAYS

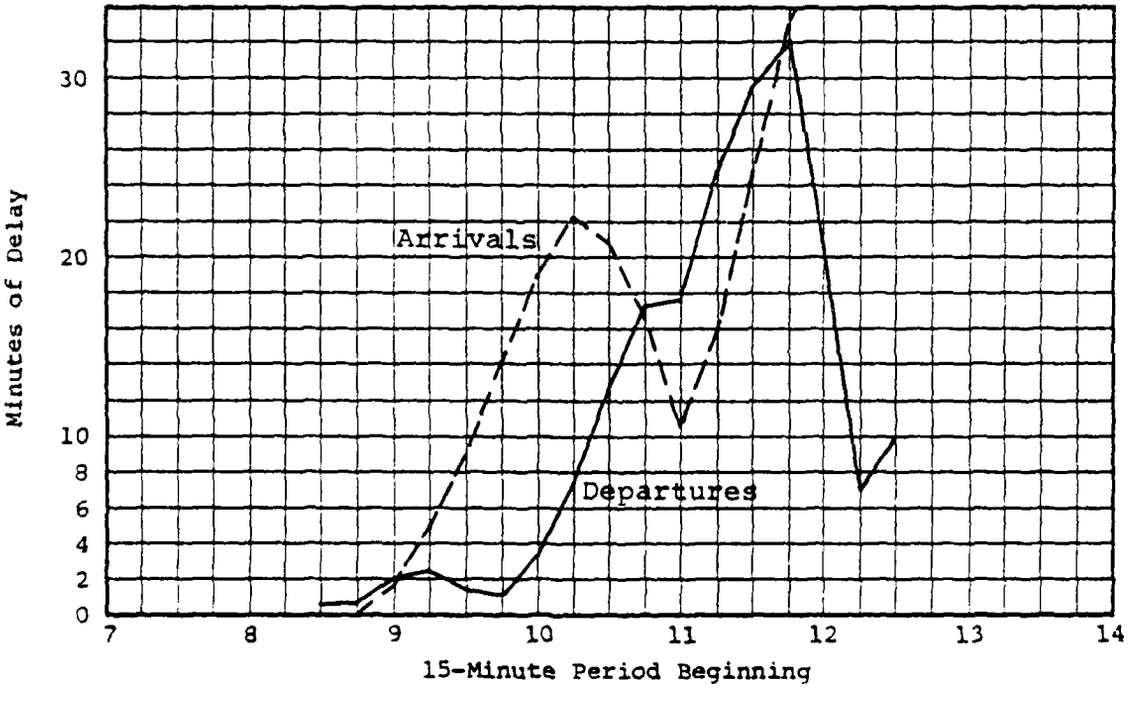


FIGURE 22C AVERAGE TAXIWAY DELAYS

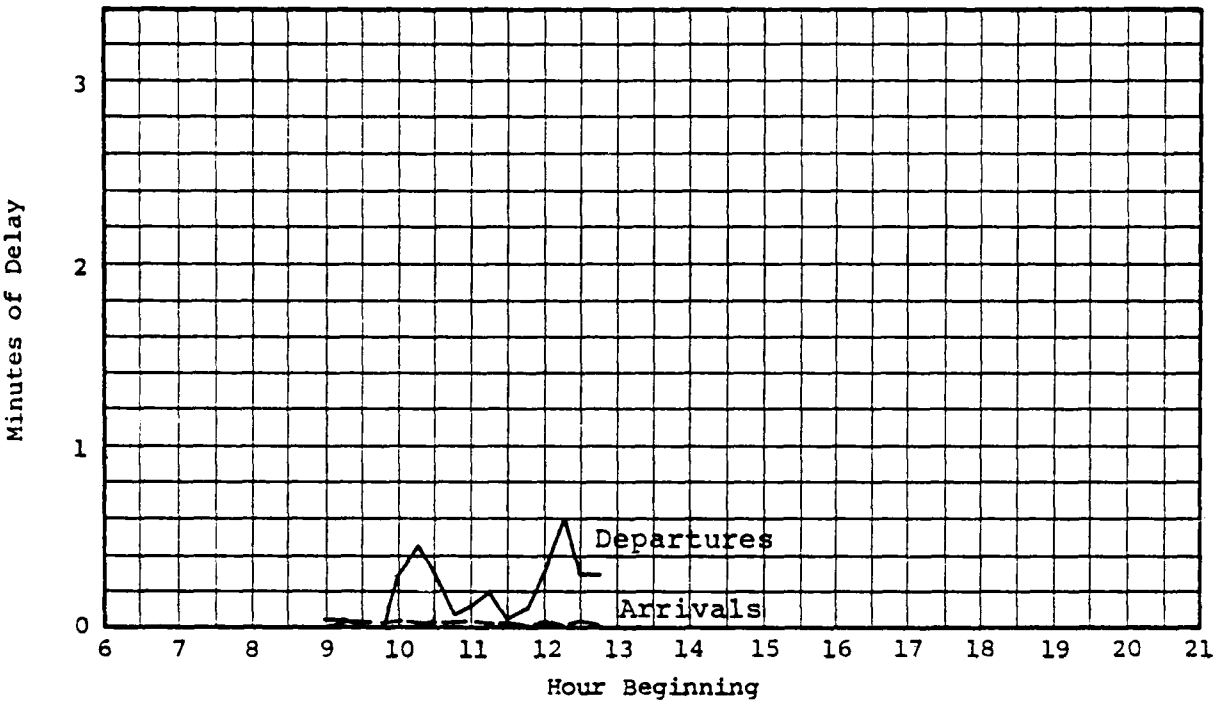
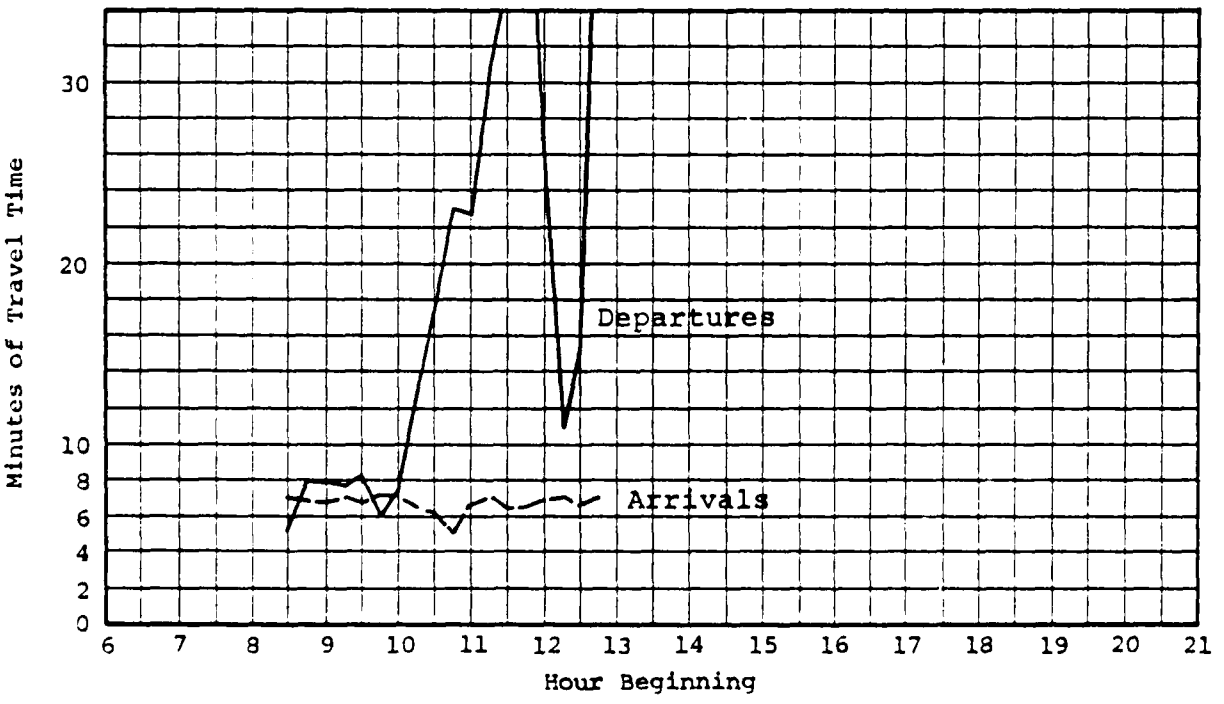


FIGURE 22D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 17

Objective:

To obtain delay estimates for 1982 demand, near-term ATC, Midfield Terminal, and the fourth runway, 8L/26R, where the "inboard" runways are used for arrivals in IFR1 weather.

Arrival Runways	Departure Runways
8R, 9L	8L, 9R

Related Comparison Experiments:

Experiment No. 18 estimates the delay for the same case but with arrivals on the "outboard" runways. Experiment No. 20 also has arrivals on the "outboard" runways, but in 1987. Experiment No. 2 is the corresponding 3-runway case.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Summary Comparison: (See Figures 17A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*
Arrival	Flow Rate (a/c per hr.)	57.5	62.0
Arrival	Air Delay (min)	16.7	39.8
Arrival	Taxi-In Delay (min)		8.0
Arrival	R/W Crossing Delay (min)		0.4
Arrival	Gate Delay (min)		0.0
Departure	Flow Rate (a/c per hr.)	53.0	70.0
Departure	R/W Delay (min)	8.0	18.7
Departure	Taxi-Out Delay (min)		1.8
Departure	R/W Crossing Delay (min)		0.2
Departure	Gate Delay (min)		2.5

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 17A AVERAGE RUNWAY FLOW RATES

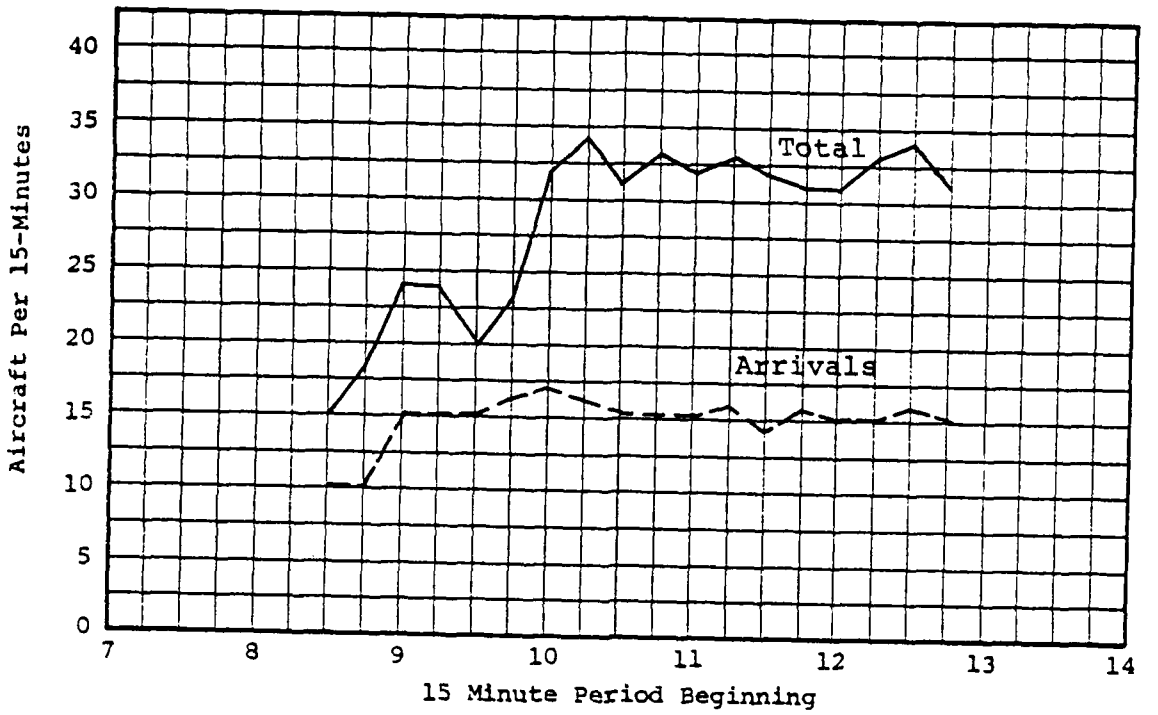


FIGURE 17B AVERAGE RUNWAY DELAYS

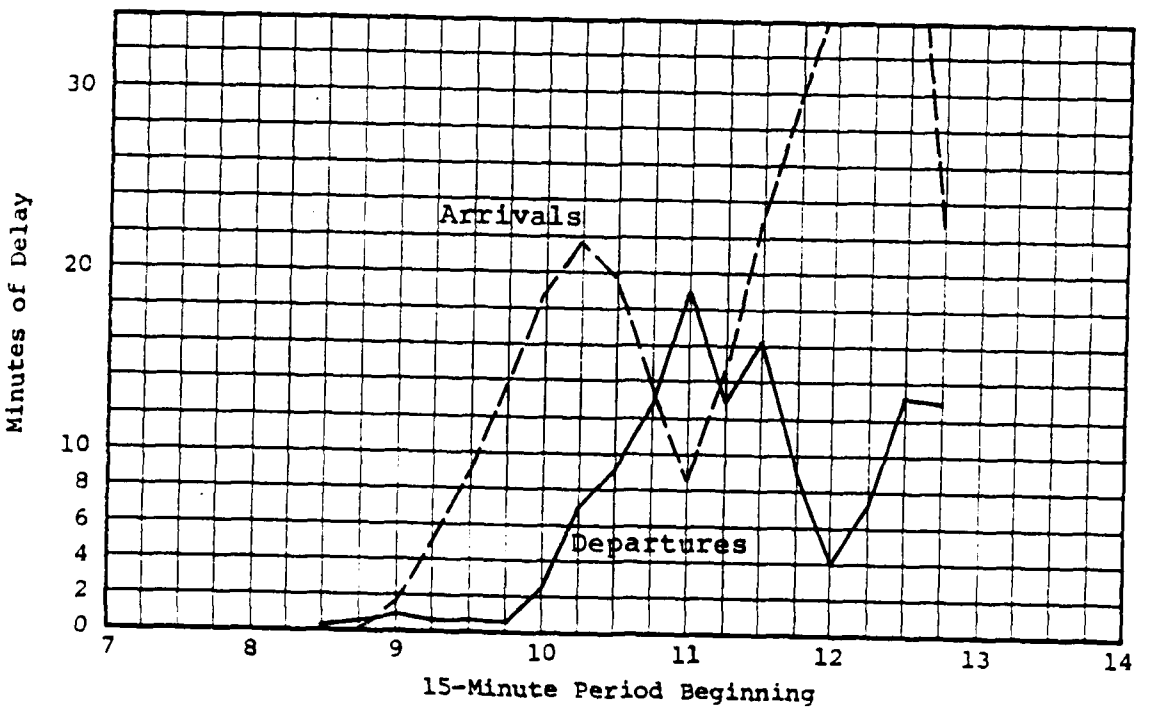


FIGURE 17C AVERAGE TAXIWAY DELAYS

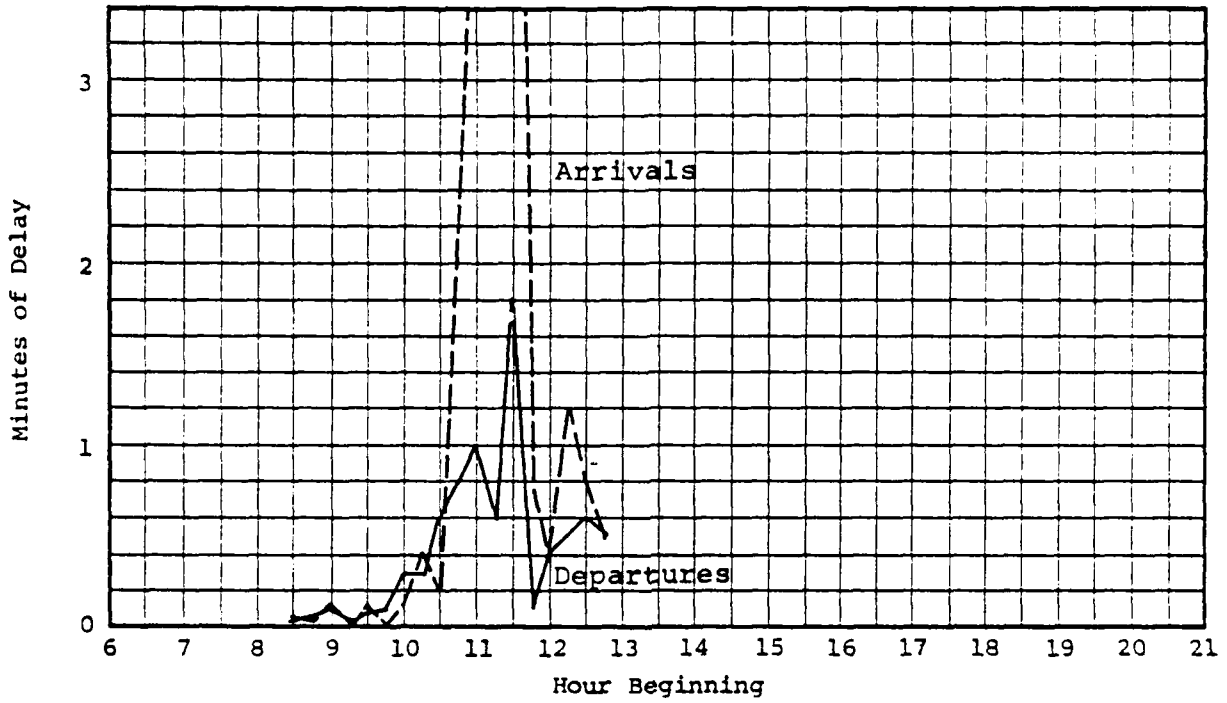
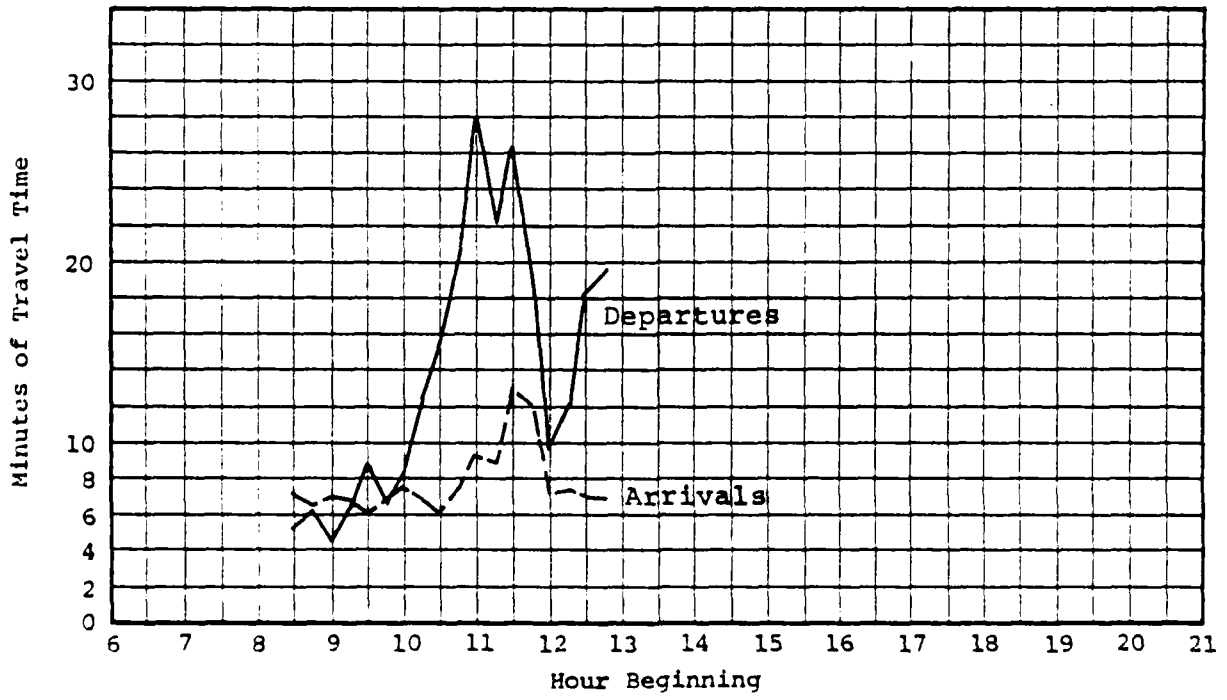


FIGURE 17D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 18

Objective:

To obtain delay estimates for 1982 demand, near-term ATC, Midfield Terminal, and the fourth runway, 8L/26R, where the "outboard" runways are used for arrivals with the following runway use in IFR1 weather.

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 17 estimates the delay for the same case but with arrivals, on the "inboard" runways. Experiment No. 20 is for "outboard" case but with 1987 demand and ATC scenario. Experiment No. 2 is the corresponding 3-runway case.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Summary Comparison: (See Figures 18A, B, C, D)

Operation Type	Performance Measure*	This Experiment		Experiment No. 17	
		Daily*	Peak*	Daily*	Peak*
Arrival	Flow Rate (a/c per hr.)	56.8	62.0	57.5	62.0
Arrival	Air Delay (min)	17.5	40.1	16.7	39.8
Arrival	Taxi-In Delay (min)		0.2		8.0
Arrival	R/W Crossing Delay (min)		0.5		0.4
Arrival	Gate Delay (min)		0.0		0.0
Departure	Flow Rate (a/c per hr.)	56.0	81.0	53.0	70.0
Departure	R/W Delay (min)	4.8	10.4	8.0	18.7
Departure	Taxi-Out Delay (min)		0.6		1.8
Departure	R/W Crossing Delay (min)		0.0		0.0
Departure	Gate Delay (min)		0.4		2.5

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 18A AVERAGE RUNWAY FLOW RATES

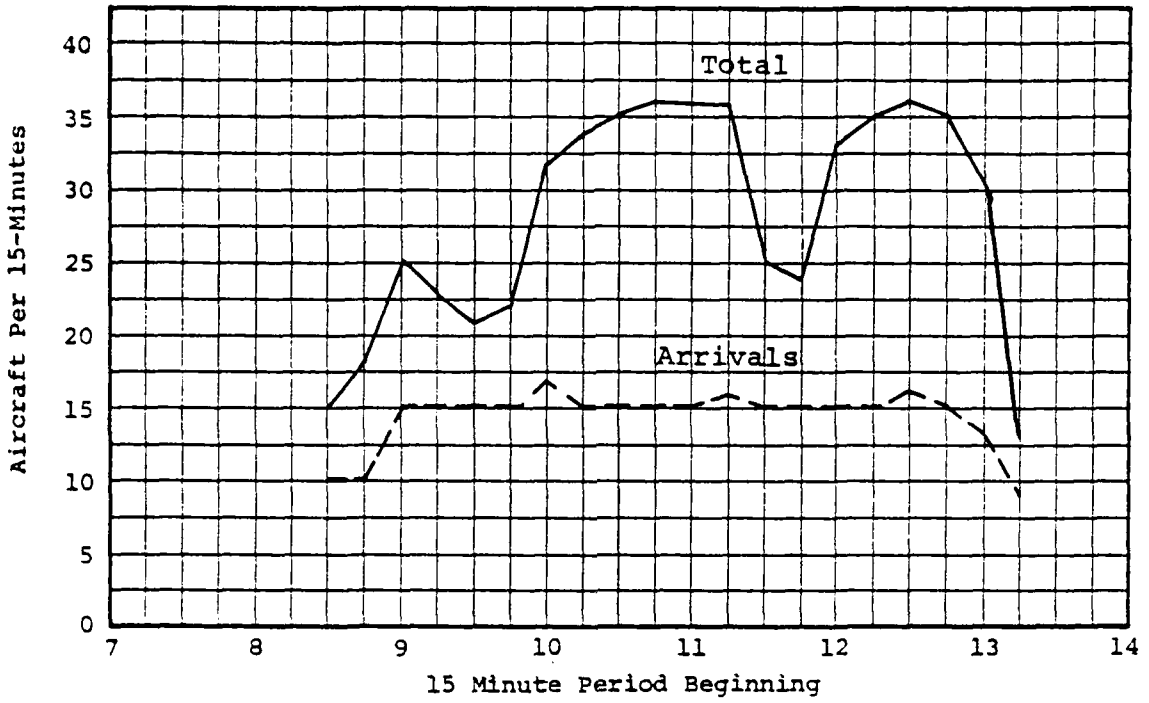


FIGURE 18B AVERAGE RUNWAY DELAYS

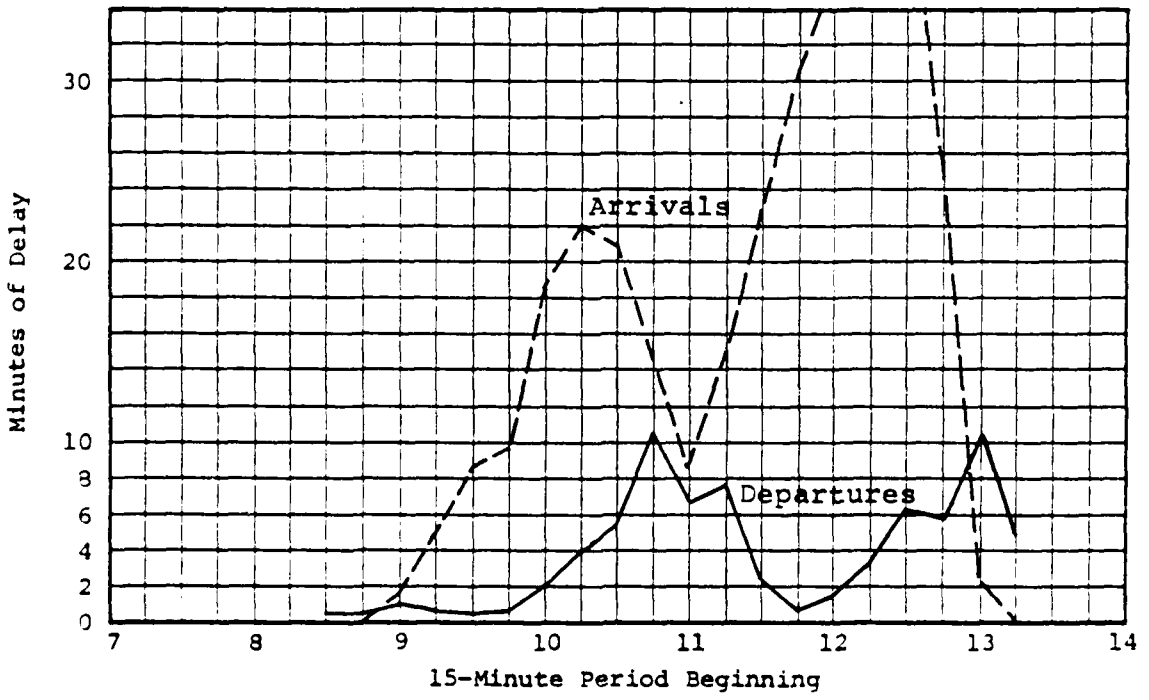


FIGURE 18C AVERAGE TAXIWAY DELAYS

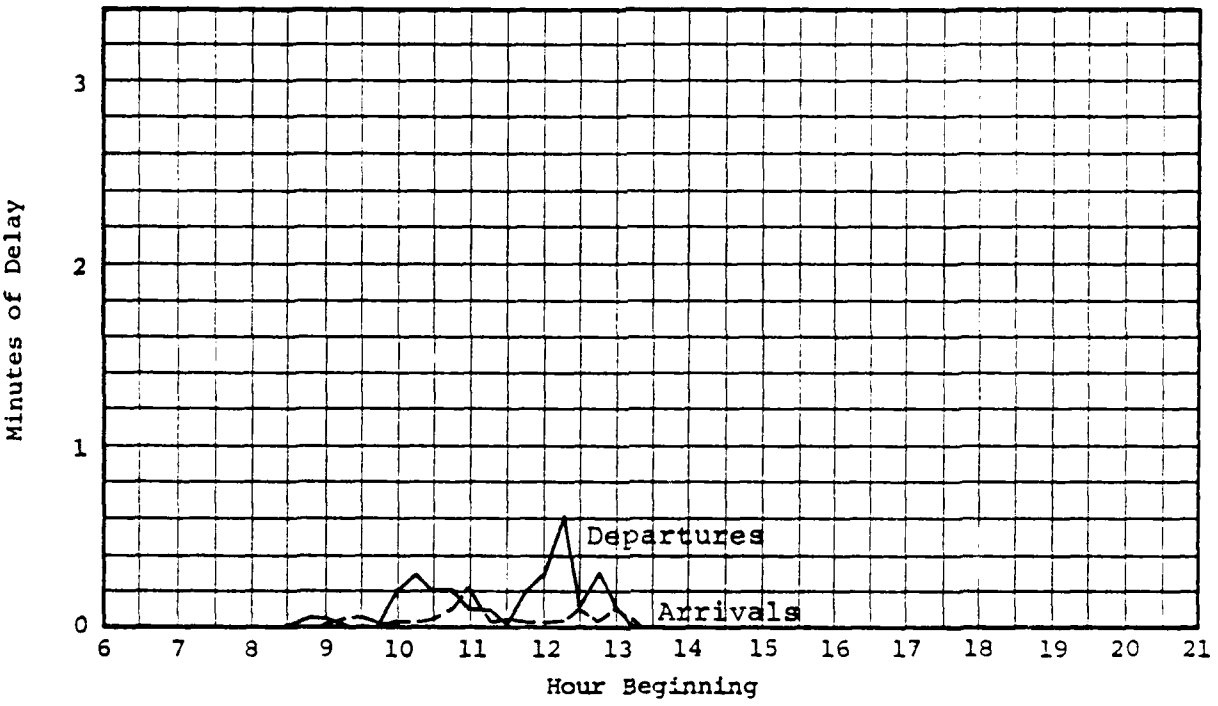
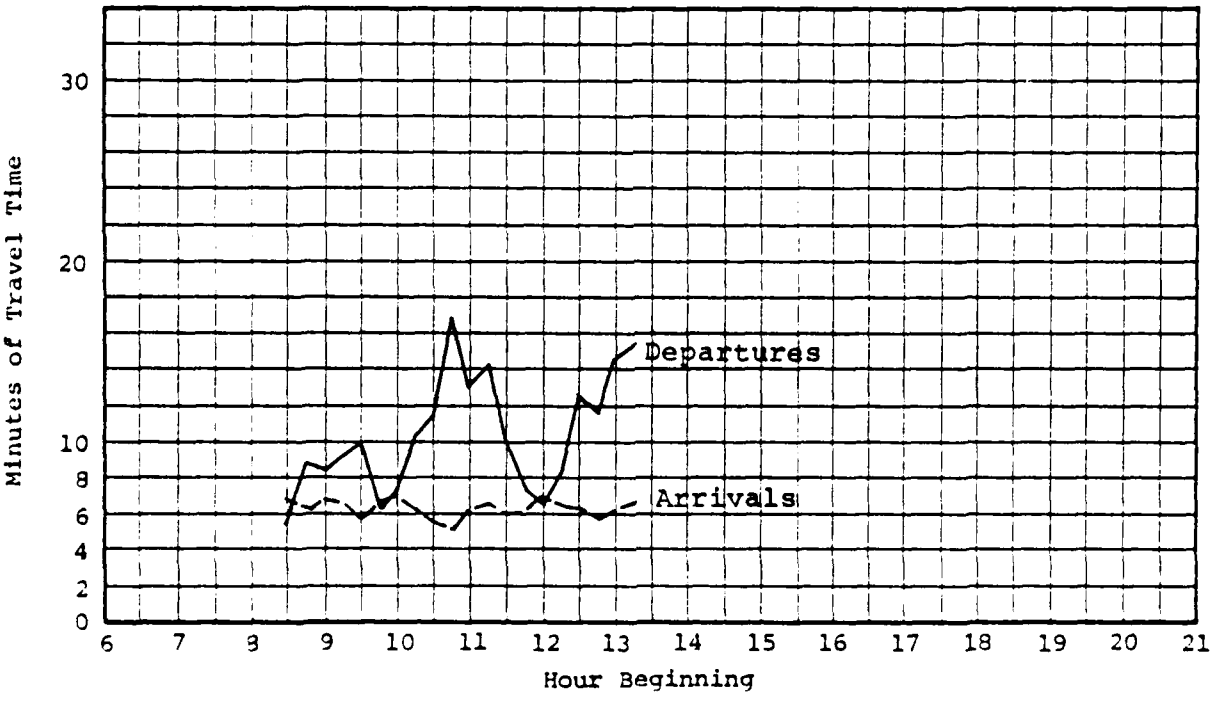


FIGURE 18D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 19

Objective:

To obtain delay estimates for 1987 demand, far-term ATC, Midfield Terminal, and the following runway use in IFR1 weather.

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment No. 2 estimates the delays for the same conditions in 1982. Experiment No. 20 has the same 1987 demand and ATC but with the fourth runway 8L/26R and arrivals on the "outboard" runways.

Length and Level of Detail of Simulation Run:

0800 to 2200 hours with 15-minute summaries.

Anticipated Results:

Lower flow rates and greater runway delays than in Experiment 20.

Summary Comparison: (See Figures 19A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*
Arrival	Flow Rate (a/c per hr.)	68.4	79.0
Arrival	Air Delay (min)	16.5	29.3
Arrival	Taxi-In Delay (min)		4.3
Arrival	R/W Crossing Delay (min)		0.2
Arrival	Gate Delay (min)		0.0
Departure	Flow Rate (a/c per hr.)	41.2	56.0
Departure	R/W Delay (min)	19.9	46.7
Departure	Taxi-Out Delay (min)		28.9
Departure	R/W Crossing Delay (min)		0.0
Departure	Gate Delay (min)		61.9

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 19A AVERAGE RUNWAY FLOW RATES

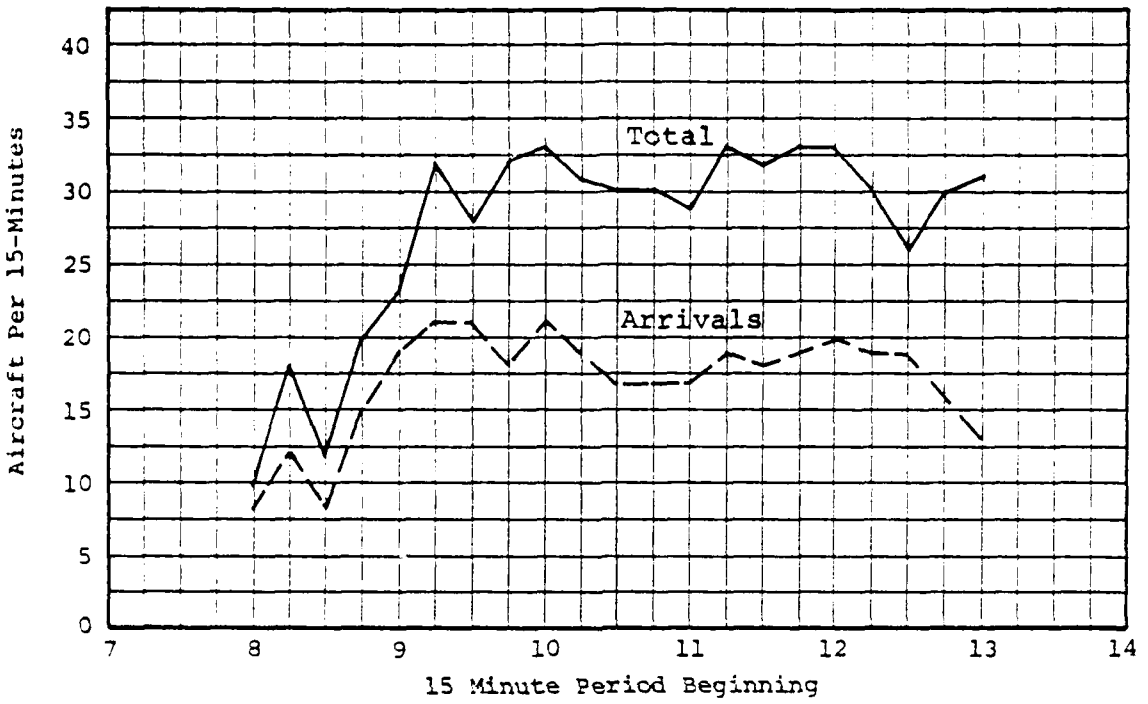


FIGURE 19B AVERAGE RUNWAY DELAYS

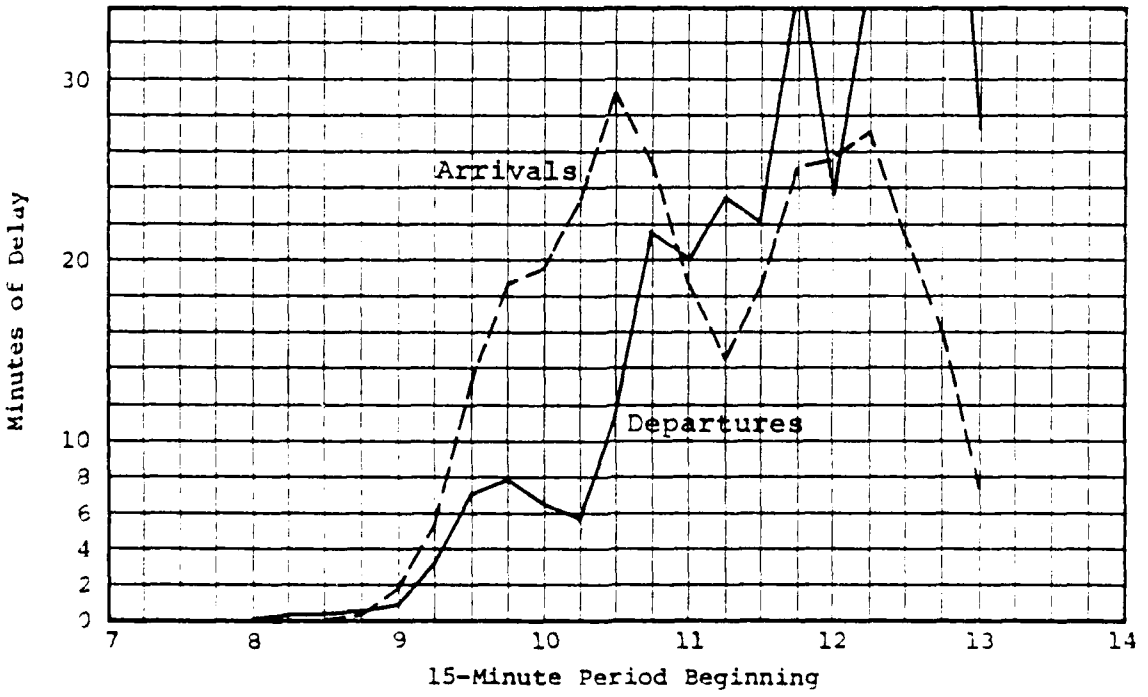


FIGURE 19C AVERAGE TAXIWAY DELAYS

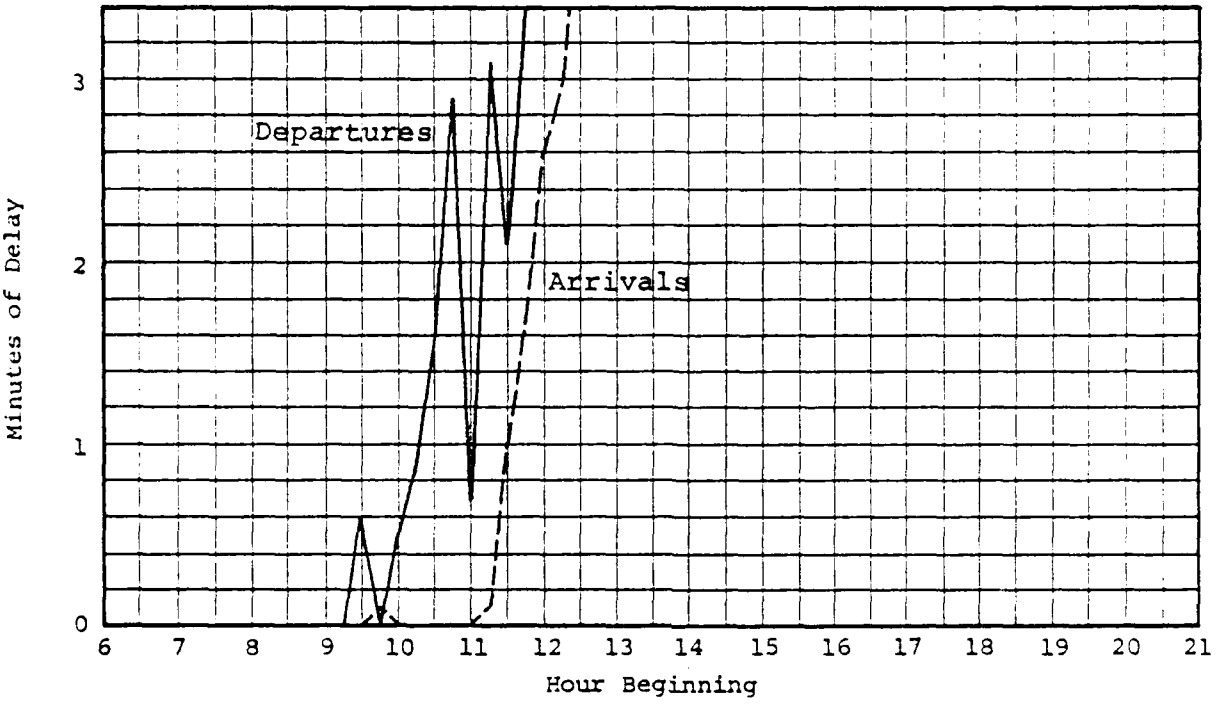
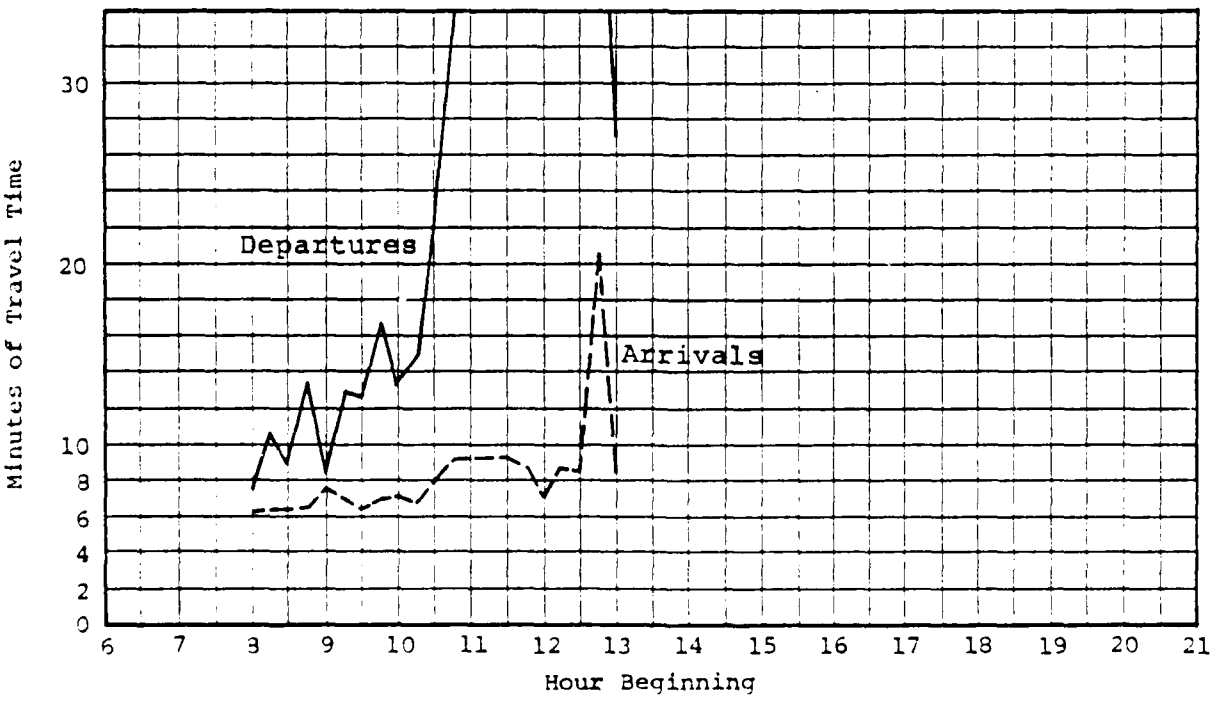


FIGURE 19D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 20

Objective:

To obtain delay estimates for 1987 demand, far-term ATC, Midfield Terminal, the fourth runway, 8L/26R, and the following runway use in IFR1 weather.

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 18 estimates the delays for the same conditions in 1982. Experiment No. 19 has the same 1987 demand and ATC, but without the fourth runway.

Length and Level of Detail of Simulation Run:

0800 to 2200 hours with 15-minute summaries.

Anticipated Results:

Greater flow rates and lower delays than in Experiment 19.

Summary Comparison: (See Figures 20A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	This Experiment Peak*	Experiment No. 19 Daily*	Experiment No. 19 Peak*
Arrival	Flow Rate (a/c per hr.)	69.2	79.0	68.4	79.0
Arrival	Air Delay (min)	13.4	28.5	16.5	29.3
Arrival	Taxi-In Delay (min)		0.2		4.3
Arrival	P/W Crossing Delay (min)		0.3		0.2
Arrival	Gate Delay (min)		1.3		0.0
Departure	Flow Rate (a/c per hr.)	61.6	87.0	41.2	56.0
Departure	P/W Delay (min)	7.7	21.1	19.9	46.7
Departure	Taxi-Out Delay (min)		2.7		28.0
Departure	P/W Crossing Delay (min)		0.0		0.0
Departure	Gate Delay (min)		11.6		61.3

*These are all average values, either over the entire simulation period (Daily) or over the peak hour or 15-min period (Peak).

FIGURE 20A AVERAGE RUNWAY FLOW RATES

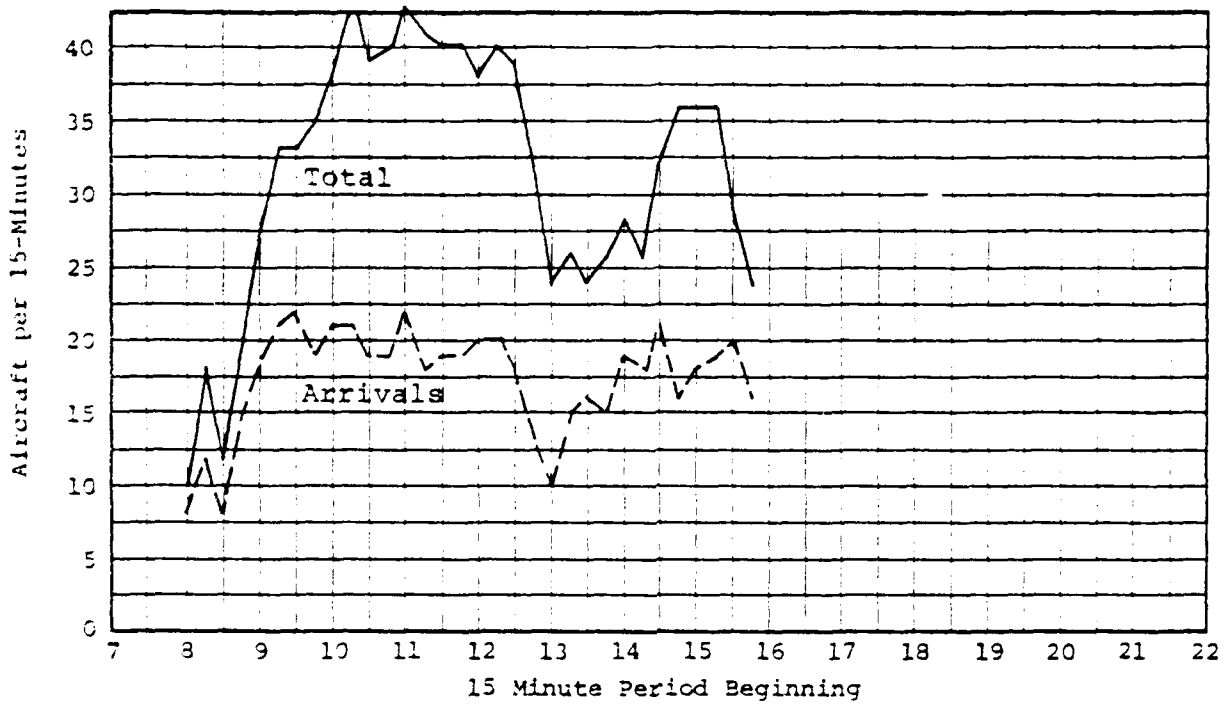


FIGURE 20B AVERAGE RUNWAY DELAYS

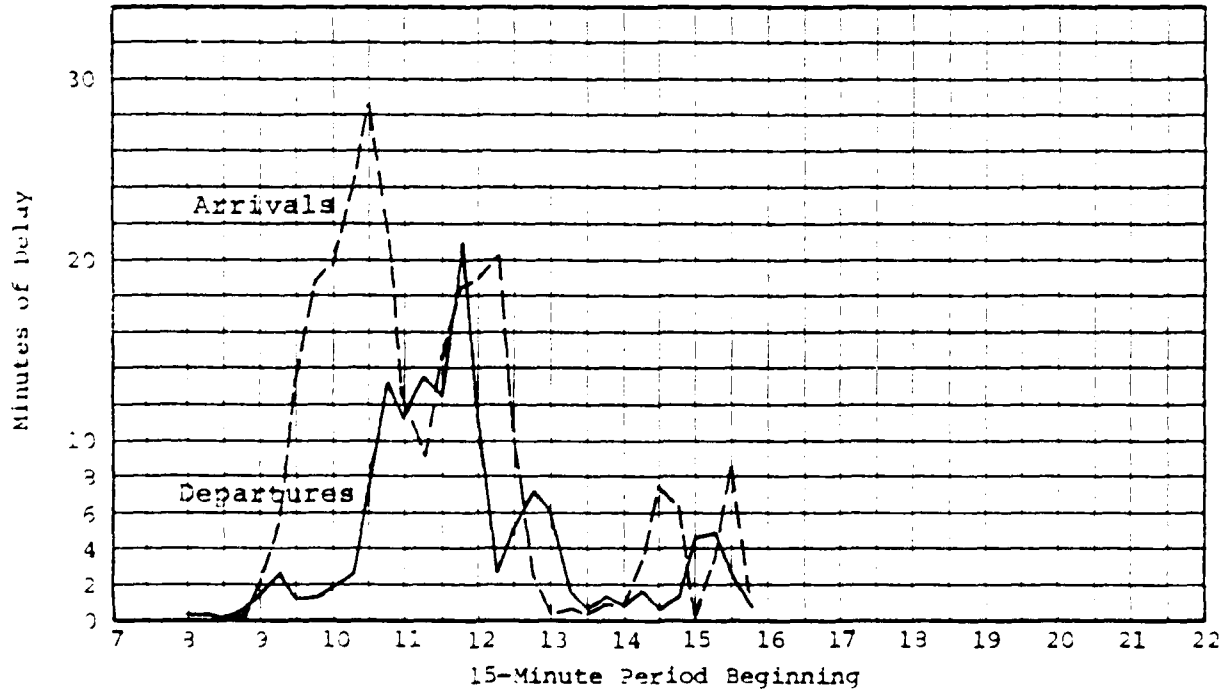


FIGURE 20C AVERAGE TAXIWAY DELAYS

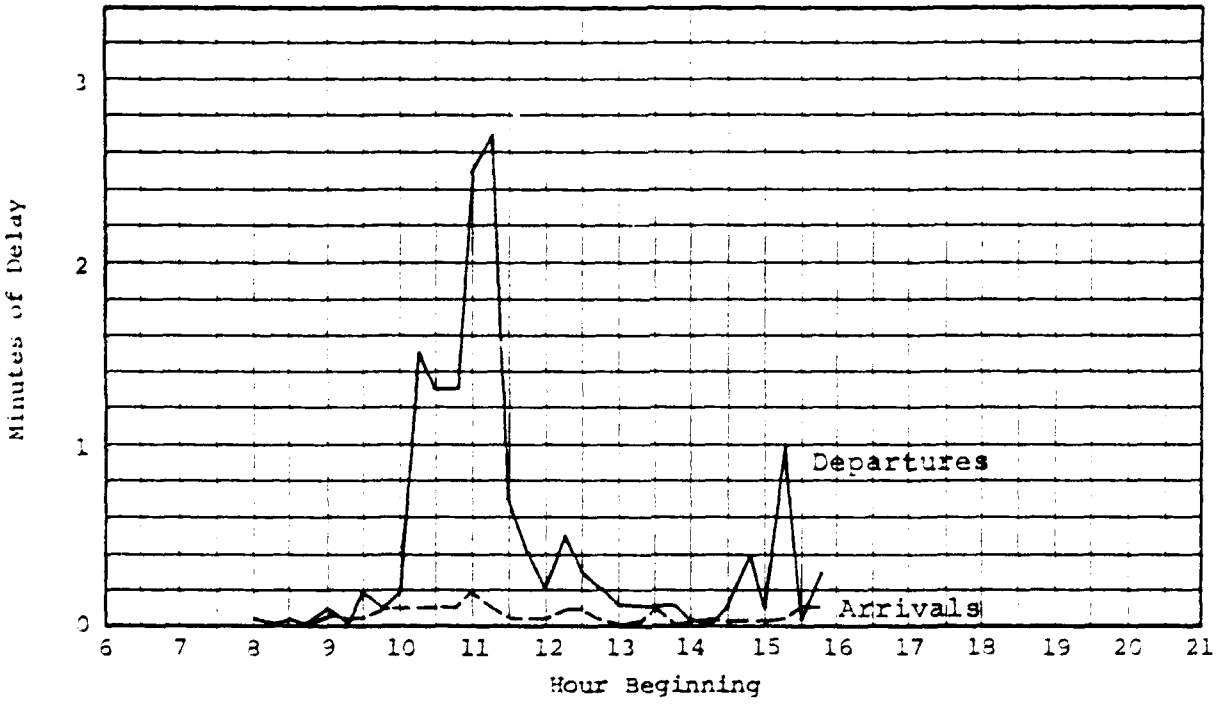
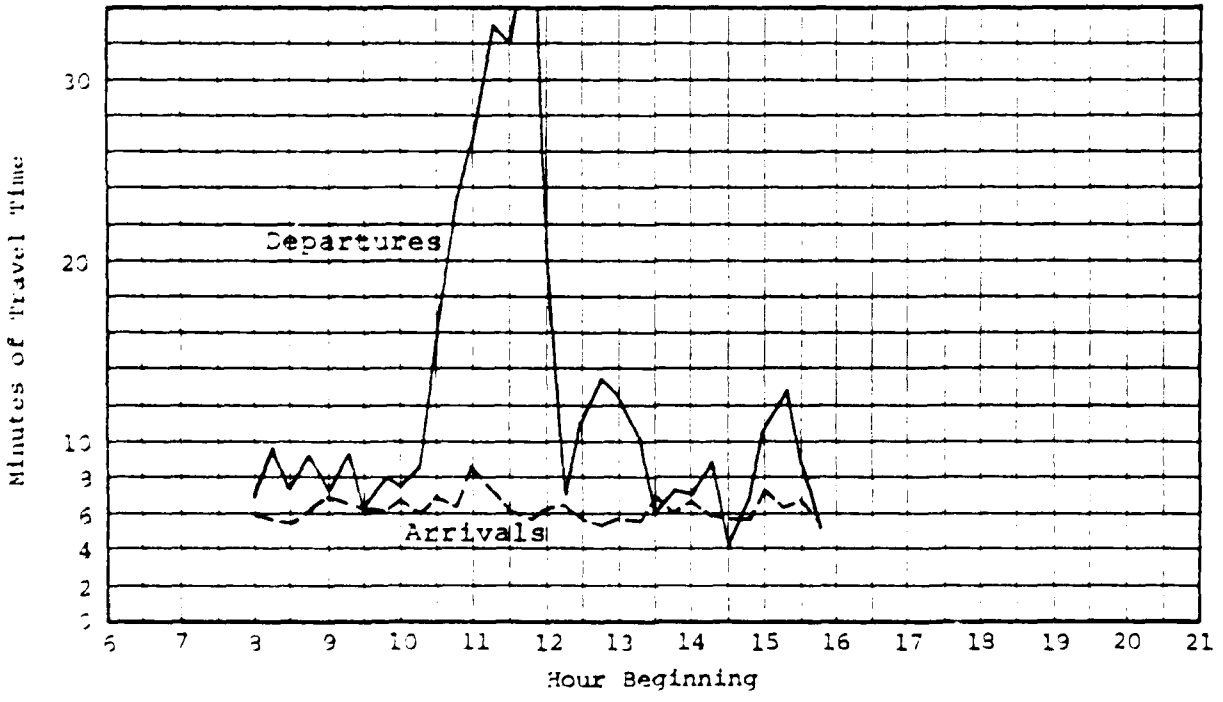


FIGURE 20D AVERAGE TAXIWAY TRAVEL TIMES



EXPERIMENT NO. 21

Objective:

To obtain delay estimates for 1987 demand, far-term ATC, Midfield Terminal, the fourth runway, 8L/26R, and the following runway use in VFR1 weather.

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 20 has the same conditions but in IFR1 weather.

Length and Level of Detail of Simulation Run:

0800 to 2200 hours with 1-hour summaries.

Anticipated Results:

Higher flow rates and lower delays than in Experiment 20.

Summary Comparison: (See Figures 21A, B, C, D)

Operation Type	Performance Measure*	This Experiment Daily*	Peak*
Arrival	Flow Rate (a/c per hr.)	69.6	82.0
Arrival	Air Delay (min)	10.0	20.4
Arrival	Taxi-In Delay (min)		0.1
Arrival	R/W Crossing Delay (min)		0.2
Arrival	Gate Delay (min)		0.4
Departure	Flow Rate (a/c per hr.)	62.2	106.0
Departure	R/W Delay (min)	1.9	3.5
Departure	Taxi-Out Delay (min)		0.7
Departure	R/W Crossing Delay (min)		0.0
Departure	Gate Delay (min)		0.1

*These are all average values, either over the entire simulation period (daily) or over the peak hour or 15-min period (Peak).

FIGURE 21A AVERAGE RUNWAY FLOW RATES

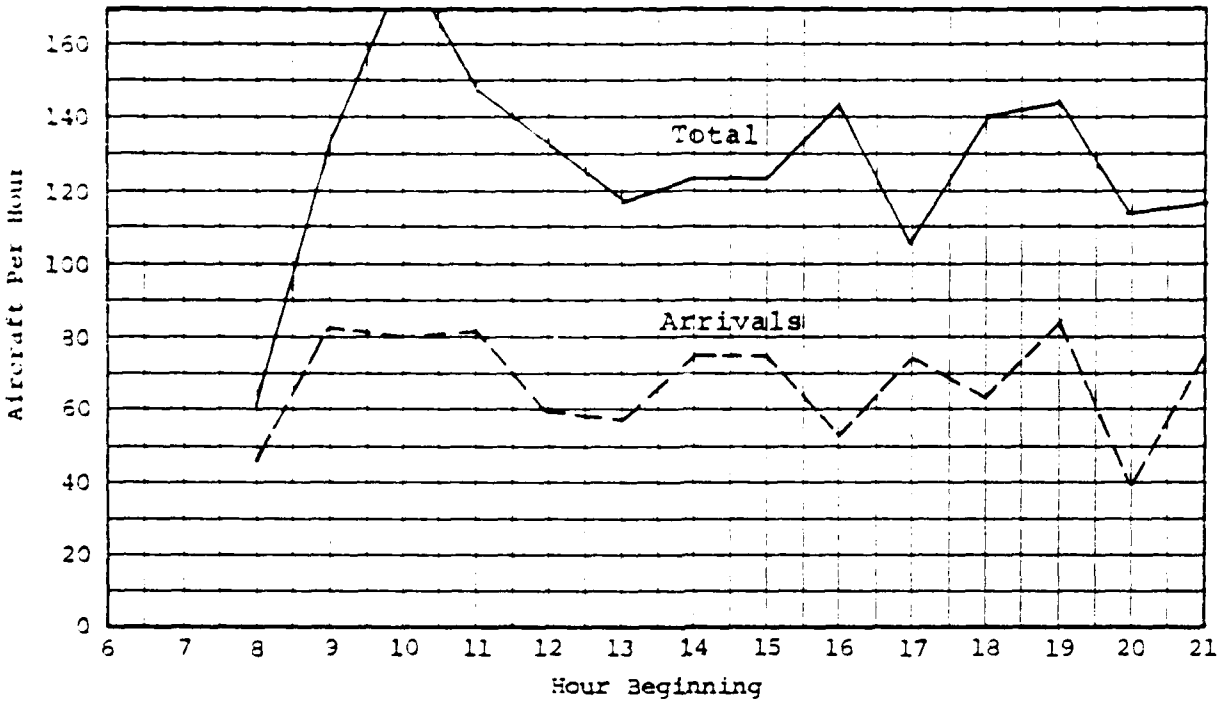


FIGURE 21B AVERAGE RUNWAY DELAYS

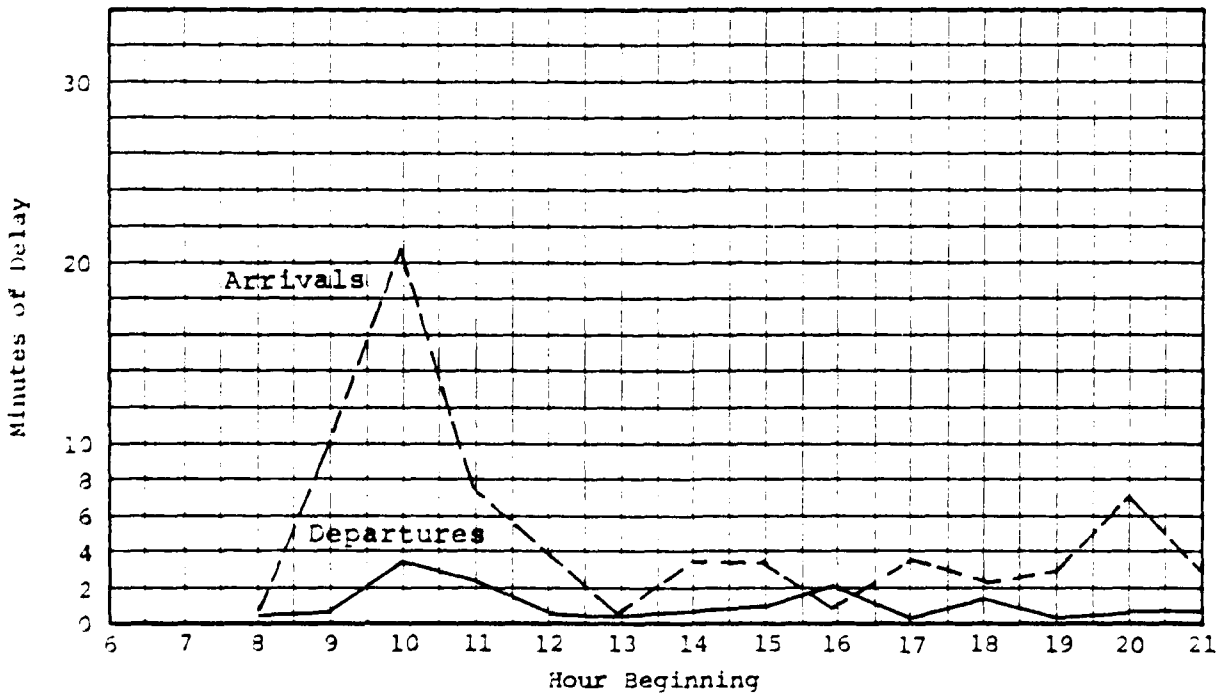


FIGURE 21C AVERAGE TAXIWAY DELAYS

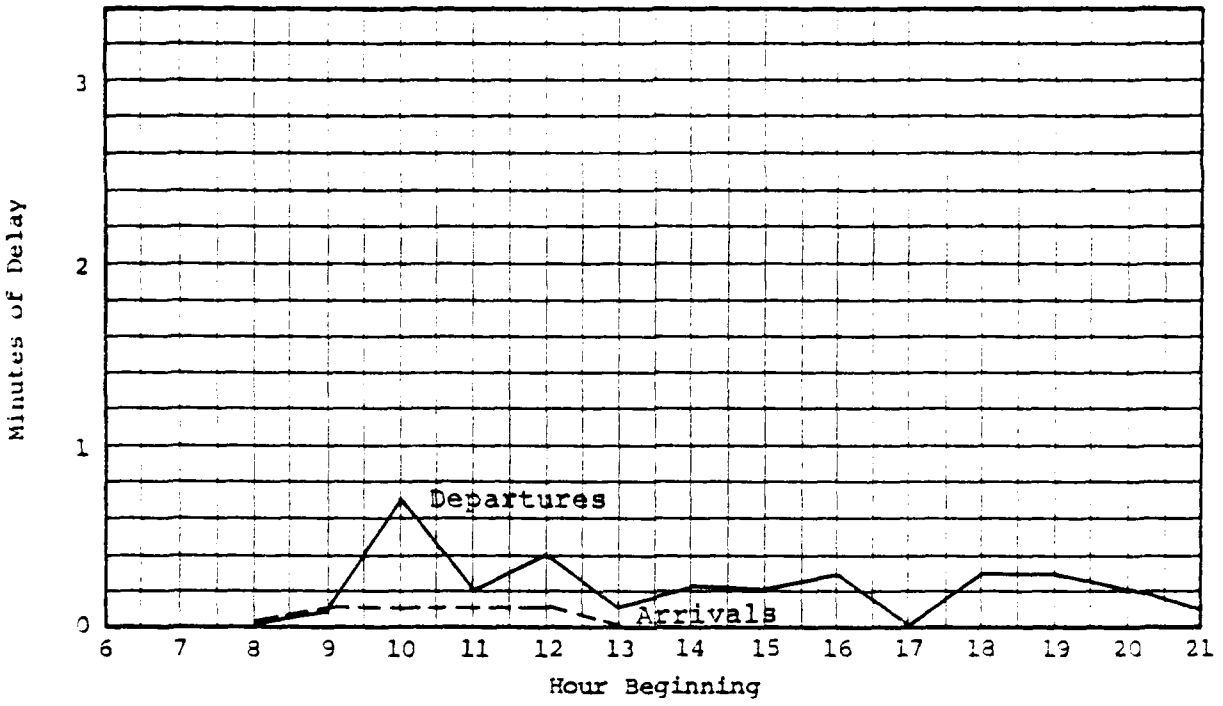
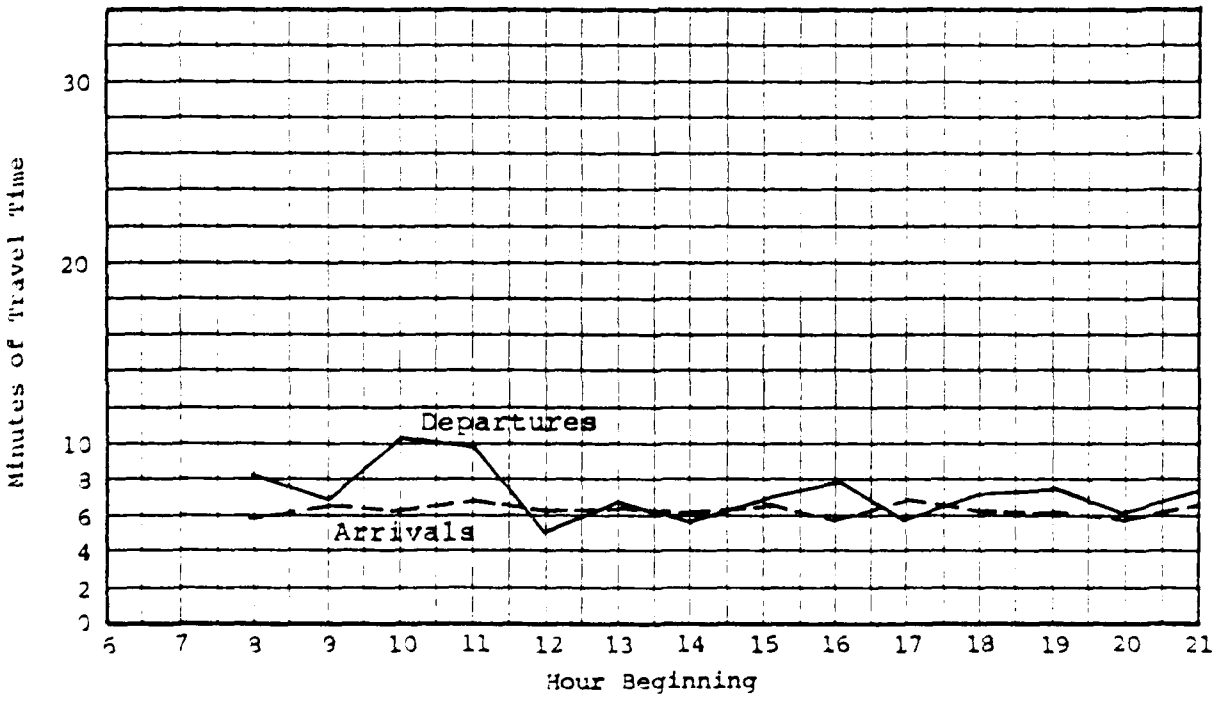


FIGURE 21D AVERAGE TAXIWAY TRAVEL TIMES



Attachment C

APPENDICES

- Summary of Stage-1 and Stage-2 Simulation Results
- Airfield Networks

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

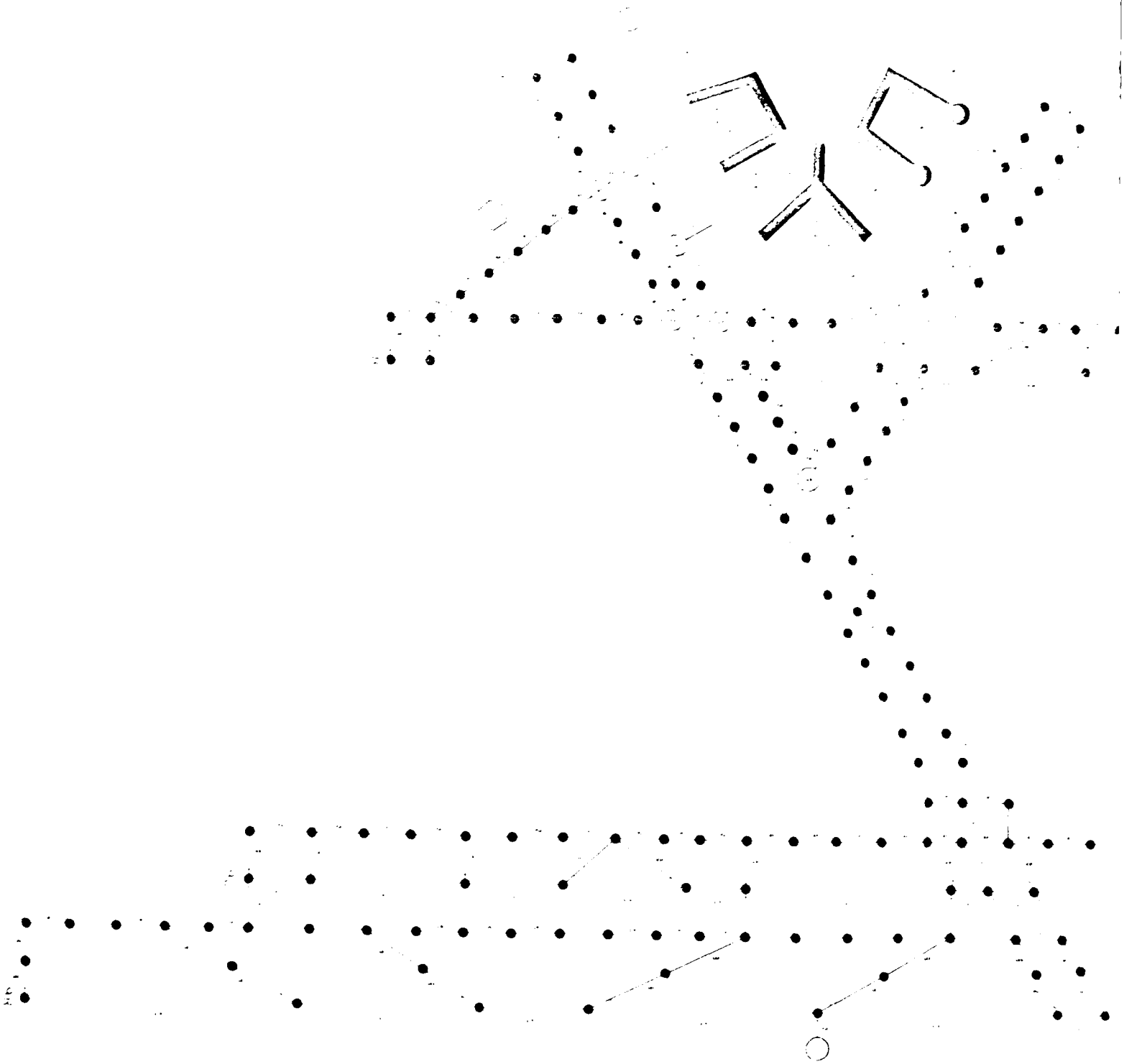
Peat, Marwick, Mitchell & Co.
San Francisco, California

October 1978

Table C-1

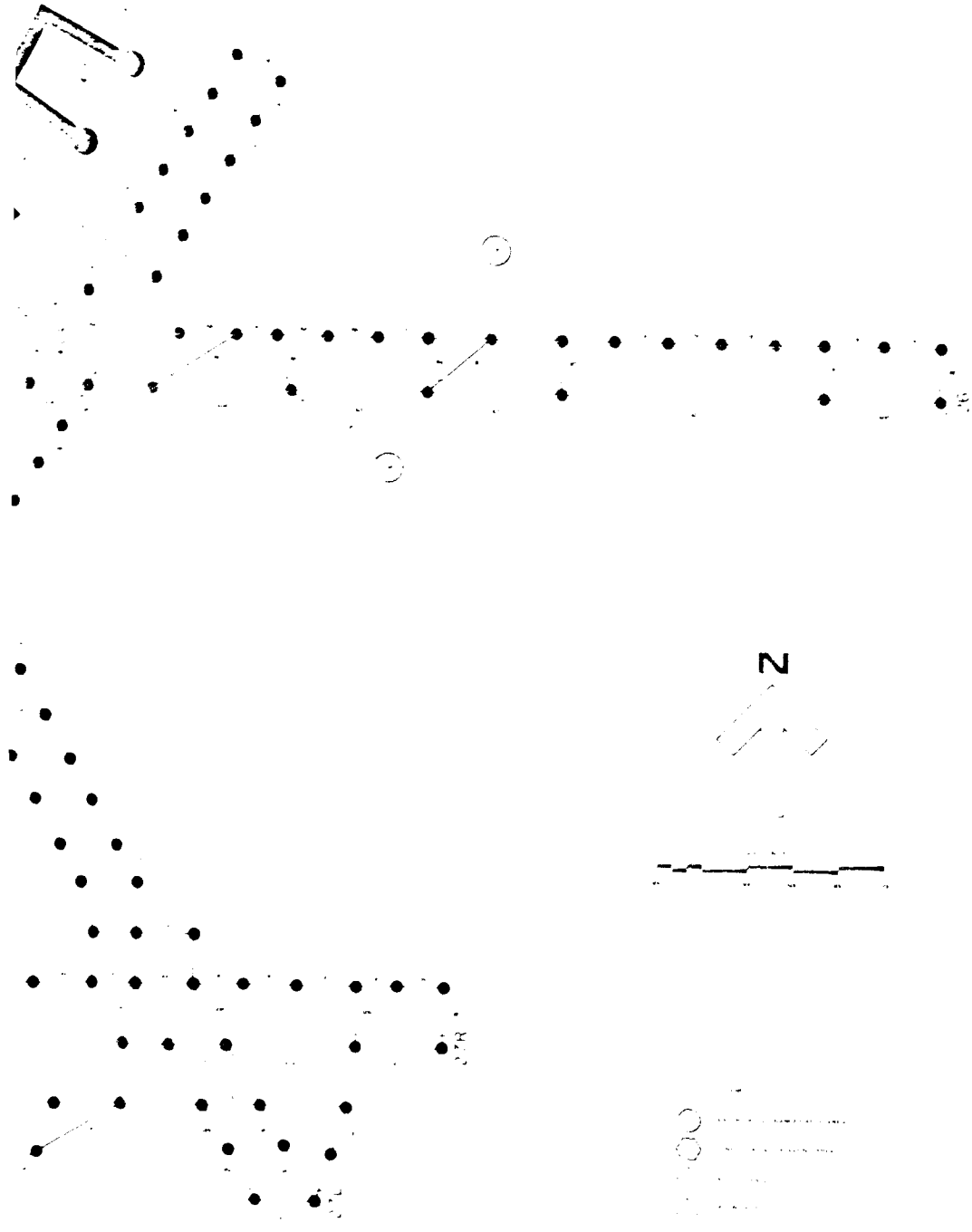
ATLANTA TASK FORCE DELAY STUDIES
RESULTS OF STAGE-1 and STAGE-2 SIMULATIONS

Experiment No.	Time & Weather	Average Hourly Flow Rates				Average Runway Delays				Average Airfield Delays						Average Ground Travel Times				Comparison Cases
		Arrivals		Departures		Arrivals		Departures		Taxi-In		Gate		Taxi-Out		Arrivals		Departures		
		Daily	Peak	Daily	Peak	Daily	Peak	Daily	Peak	Daily	Peak	Arr.	Dep.	Daily	Peak	Daily	Peak	Daily	Peak	
1A	1978/VFR1	49.6	70	47.4	70	7.2	11.4	7.2	11.3	0.3	1.3	2.1	0.6	11.7	12.5	Baseline				
2A	1978/IFR1	47.8	54	41.4	58	23.5	42.8	13.6	23.8	5.9	2.5	42.1	4.5	11.4	29.6	Baseline				
1	1982/VFR1	53.0	76	51.0	77	6.1	10.9	6.6	8.0	0.0	0.1	2.3	1.0	7.3	10.6	1A				
2	1982/IFR1	56.4	62	49.2	62	17.7	32.5	12.6	19.4	0.2	0.0	141.4	5.5	10.8	19.0	2A				
28	1978/IFR1	47.6	54	40.4	56	23.9	42.7	13.3	22.3	7.4	2.4	36.7	8.5	11.3	25.9	2A				
22	1982/IFR1	56.5	62	46.2	60	18.0	43.8	14.5	31.8	0.0	0.0	0.0	0.5	7.2	9.1	2				
17	1982/IFR1	57.5	62	53.0	70	16.7	39.8	8.0	18.7	8.0	0.0	2.5	1.8	12.9	9.3	18, 20, 2				
18	1982/IFR1	56.8	62	56.0	81	17.5	40.1	4.8	10.4	0.2	0.0	0.4	0.6	7.0	6.3	17, 20, 2				
19	1987/IFR1	68.4	79	41.2	56	16.5	29.3	19.9	46.7	4.3	0.0	61.9	28.9	9.3	40.2	2, 20				
20	1987/IFR1	69.2	79	61.6	87	13.4	28.5	7.7	21.1	0.2	1.3	11.6	2.7	7.3	22.5	18, 19				
21	1987/VFR1	69.6	82	62.2	106	10.0	20.4	1.9	3.5	0.1	0.4	0.1	0.7	6.7	6.7	20, 1, 1A				



AIRFIELD NETWORK

WILLIAM B. HARTSFIELD ATLANTA INTERNAT



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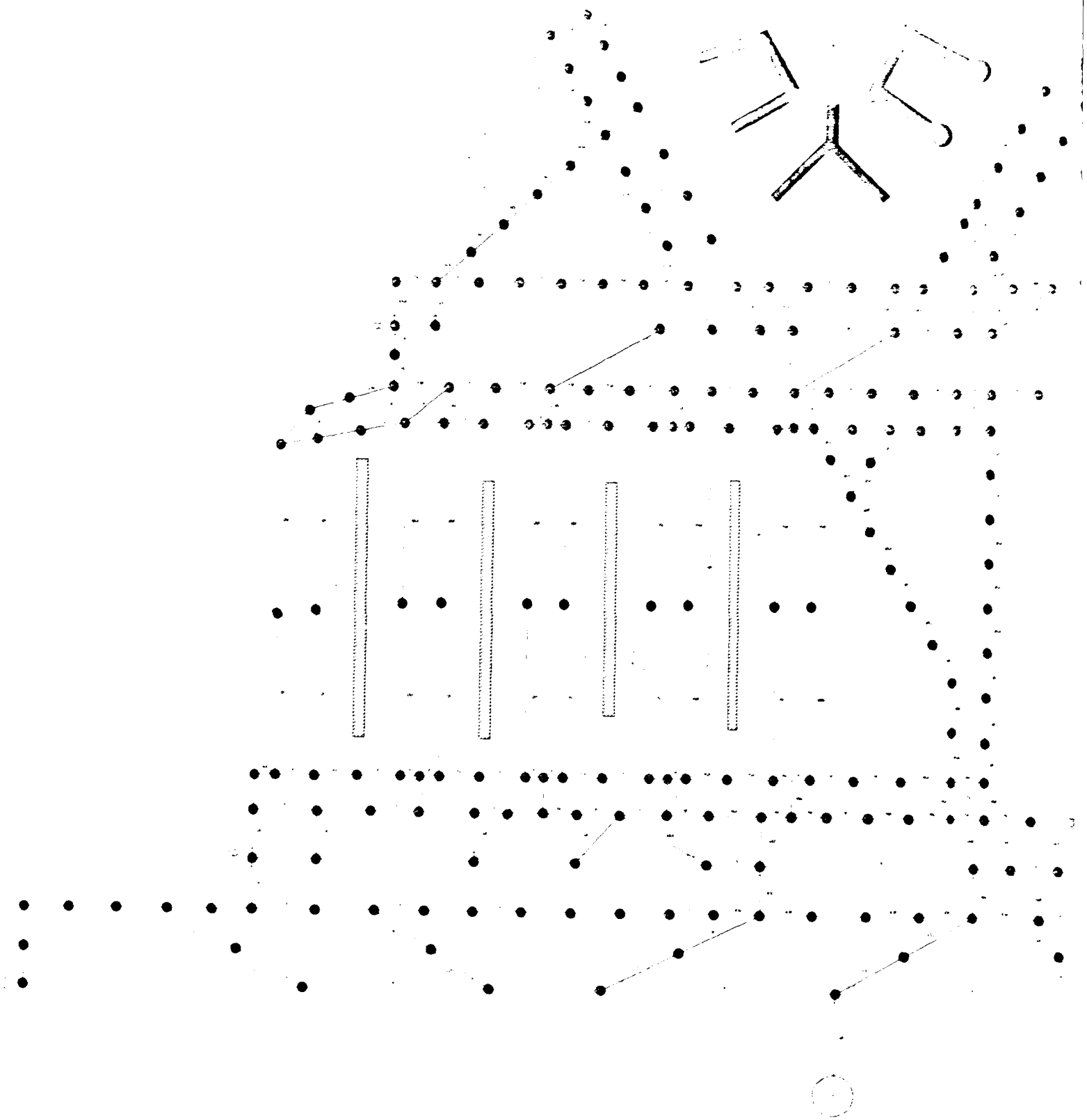
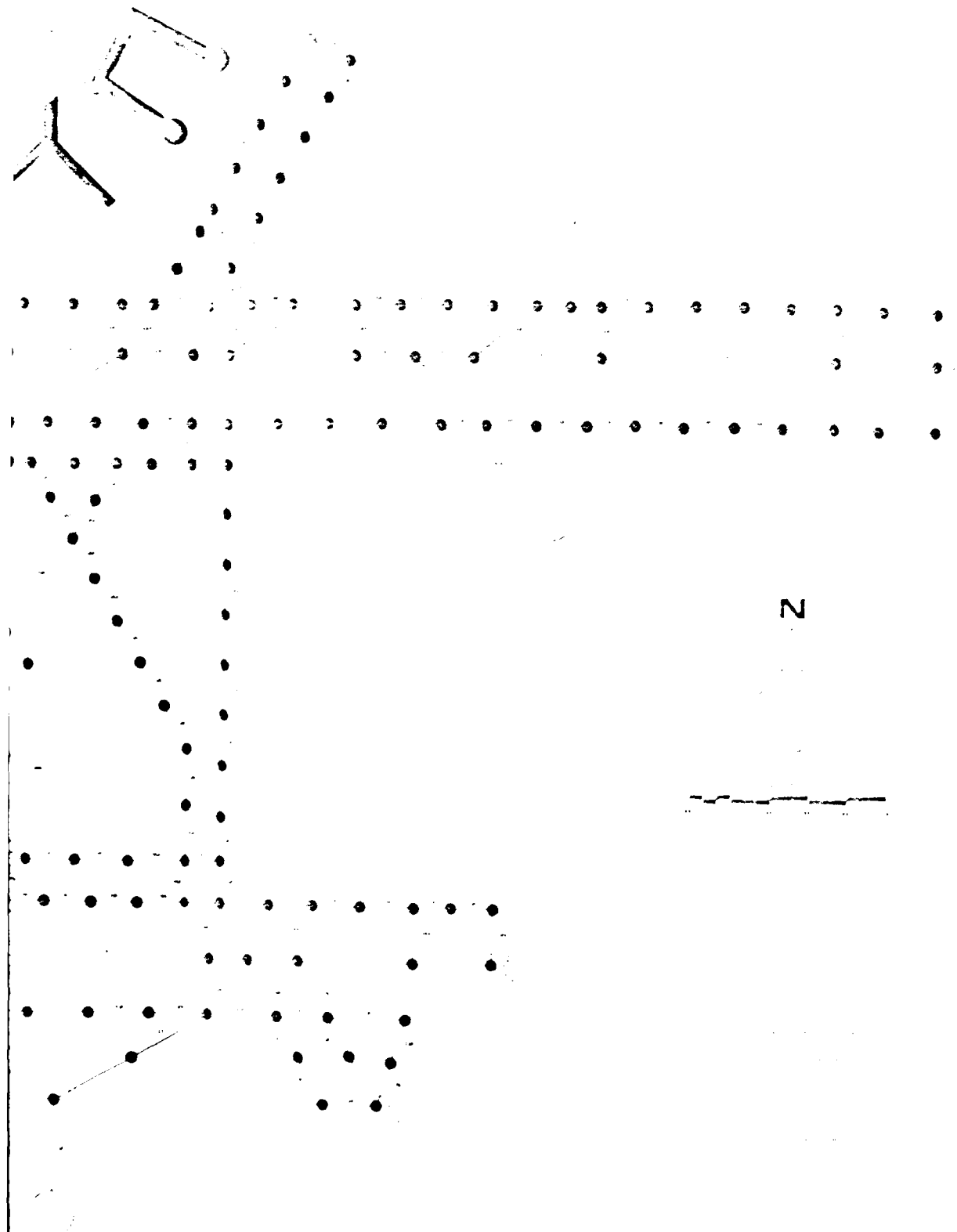
A INTERNATIONAL AIRPORT



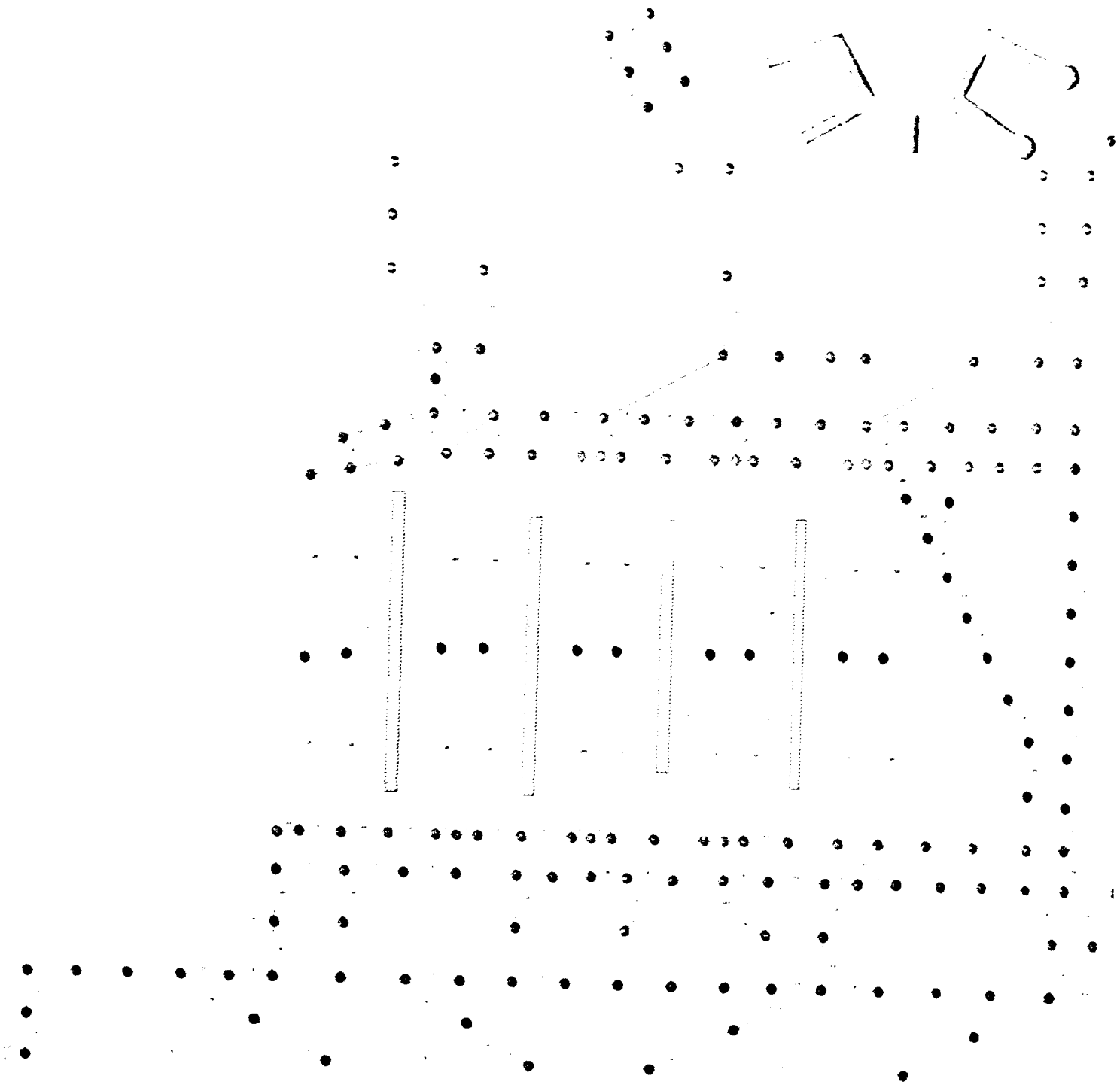
FUTURE AIRFIELD NETWORK

WILLIAM B. HARTSFIELD ATLANTA INTERN



ELD NETWORK

ANTA INTERNATIONAL AIRPORT



FUTURE AIRFIELD NETWO

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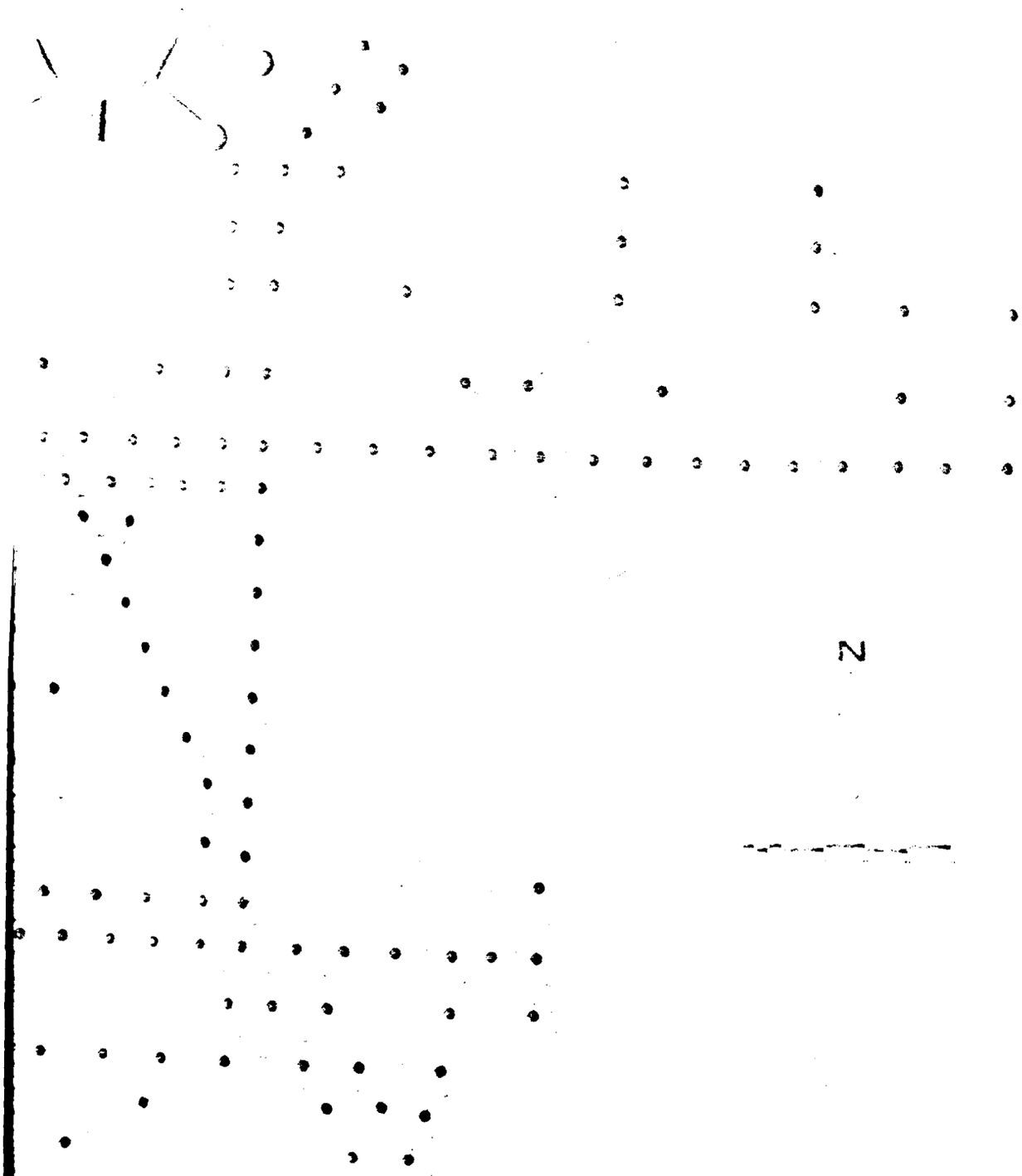

LD NETWORK

ANTA INTERNATIONAL AIRPORT

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TASK FORCE DELAY STUDY. WILLIAM B. HARTSFIELD ATLANTA INTERNATI--ETC(U)
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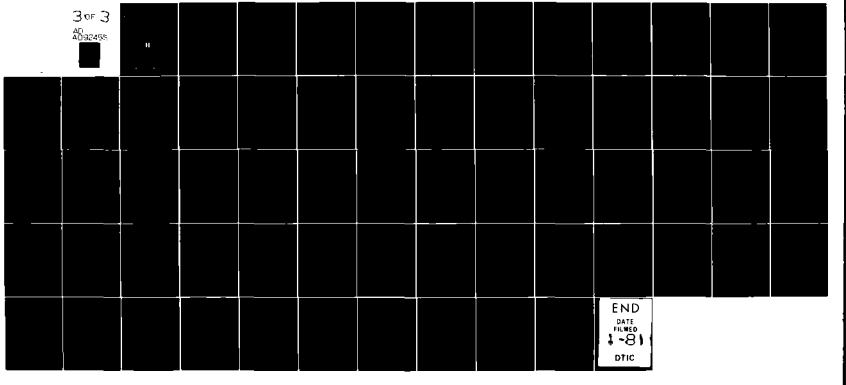
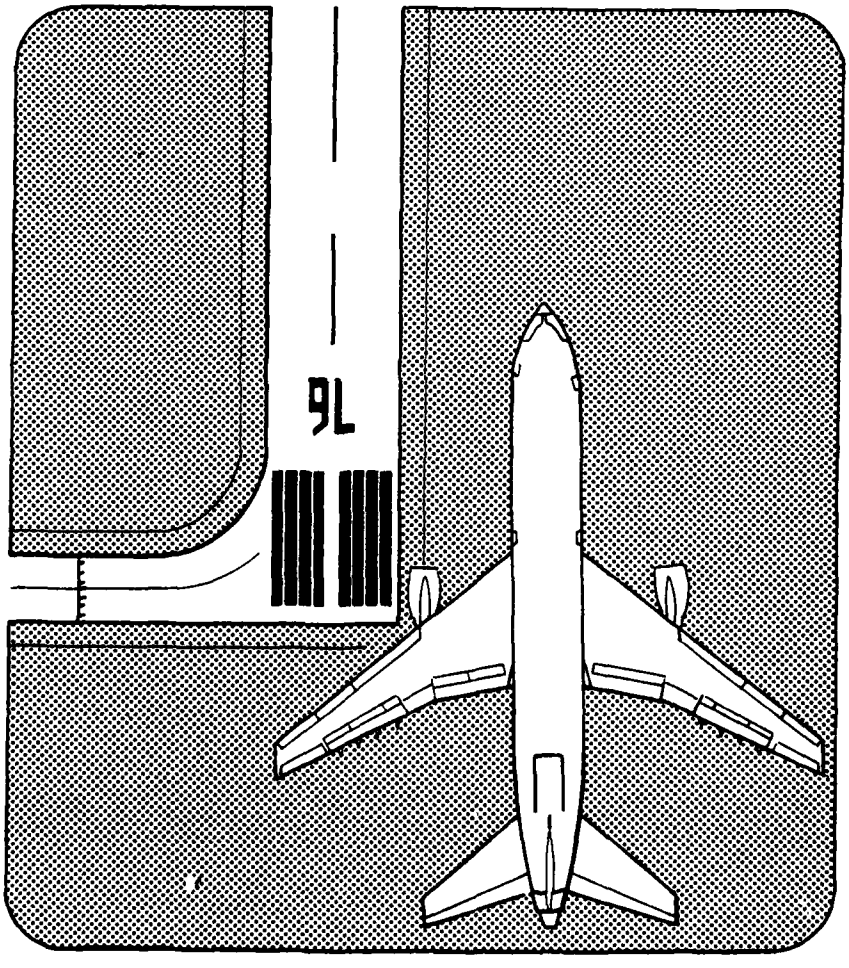


WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

DATA PACKAGE NO. 5

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES



prepared for

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

under contract

DOT FA77WA –3961

PMM&Co. Peat, Marwick, Mitchell & Co.

DECEMBER 1978

PEAT, MARWICK, MITCHELL & CO.
P. O. BOX 8007
SAN FRANCISCO INTERNATIONAL AIRPORT
SAN FRANCISCO, CALIFORNIA 94128

Telephone: (415) 347-9521

December 11, 1978

Mr. Ray Fowler, AEM-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Re: Atlanta Data Package No. 5

Dear Ray:

Enclosed is Data Package No. 5 for William B. Hartsfield Atlanta International Airport. The package contains revised results of certain Stage 1 and Stage 2 experiments and results of the annual delay model runs. Furthermore, the presentation of all of the Stage 1 and Stage 2 results has been improved by showing results for the peak-demand hour and for the morning peak 3-hour period, which contains both the arrival peak hour and the departure peak hour.

These results should be reviewed by the Atlanta Task Force during the December 13, 1978, Task Force meeting.

Sincerely,

Stephen L. M. Hockaday
Manager

SLMH/nbe
Enclosure

cc: Mr. J. R. Dupree, ALG-132
Mr. B. Drotts, ASO-4 (w/encl)

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES
Atlanta International Airport
Data Package No. 5

TABLE OF CONTENTS

Attachment A

RESULTS OF STAGE-1 DELAY SIMULATIONS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

December 1978

Table A-1

ATLANTA TASK FORCE DELAY STUDIES
INDEX TO REVISED RESULTS
STAGE 1 EXPERIMENTS

Experiment No.	Model	Runways		Weather	Demand/ Improvement ATC	Page
		Arrivals	Departures			
1A	ASM	8, 9R	8, 9L	VFR1	1978	3
2A	ASM	8, 9R	8, 9L	IFR1	1978	4
1	ASM	8, 9R	8, 9L	VFR1	1982	5
2	ASM	8, 9R	8, 9L	IFR1	1982	6
3	ASM	9R	8, 9L	IFR2	1982	7
5	ASM	8, 9R	8, 9L	IFR1	1982- 2 n.m. stagger	9
6	ASM	8, 9R	8, 9L	IFR1	1982- 1.5 n.m. stagger	10

EXPERIMENT NO. 1A

Objective:

To obtain 1978 baseline delay estimates in VFR1 weather for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment 2A has same demand and network but in IFR1 weather.

Length and Level of Detail of Simulation Run:

From 0800 to 2200 hours with 1-hour summaries.

Anticipated Results:

Lower delays than in Experiment 2A.

Results:

Operation Type	Performance Measure	This Experiment 0900-1200 Average[a]	Peak[b]
Arrival	Runway Delay (min)	9.2	6.2
Arrival	Taxi-In Delay (min)[c]	0.2	0.4
Arrival	Gate Delay (min)	0.8	0.1
Departure	Runway Delay (min)	8.0	7.6
Departure	Taxi-Out Delay (min)[c]	0.4	0.5
Departure	Gate Delay (min)	1.3	2.1

a. Average over the period 0900-1200 hours.
b. For peak demand hour, 1000-1100 hours.
c. Includes runway crossing delay.

EXPERIMENT NO. 2A

Objective:

To obtain 1978 baseline delay estimates in IFR1 weather for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment 1A has same demand and network but in VFR1 weather.

Length and Level of Detail of Simulation Run:

From 0800 to 1300 hours with 1-hour summaries.

Anticipated Results:

Higher delays than in Experiment 1A.

Results:

Operation Type	Performance Measure	This Experiment 0900-1200 Average[a]	Peak[b]
Arrival	Runway Delay (min)	23.8	29.1
Arrival	Taxi-In Delay (min)[c]	0.7	0.6
Arrival	Gate Delay (min)	0.6	0.1
Departure	Runway Delay (min)	9.9	8.8
Departure	Taxi-Out Delay (min)[c]	0.8	0.5
Departure	Gate Delay (min)	2.2	1.6

a. Average over the period 0900-1200 hours.
b. For the peak-demand hour, 1000-1100 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 1

Objective:

To obtain delay estimates in VFR1 weather with the new Midfield Terminal, 1982 demand, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared with Experiment No. 1A, which was for the old terminal and 1978 demand and ATC separations in VFR1 weather.

Length and Level of Detail of Simulation Run:

From 0800 to 2200 hours with 1-hour summaries..

Summary Comparison:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment 1000-1300 Peak[b]	Experiment No. 1A 0900-1200 Average	Experiment No. 1A 0900-1200 Peak[b]
Arrival	Runway Delay (min)	10.1	11.9	9.2	6.2
Arrival	Taxi-In Delay (min)[c]	0.1	0.2	0.2	0.4
Arrival	Gate Delay (min)	0.1	0.0	0.8	0.1
Departure	Runway Delay (min)	9.9	15.2	8.0	7.6
Departure	Taxi-Out Delay (min)[c]	0.3	0.3	0.4	0.5
Departure	Gate Delay (min)	0.2	0.4	1.3	2.1

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 2

Objective:

To obtain delay estimates in IFR1 weather with the Midfield Terminal, 1982 demand, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared to Experiment No. 2A to examine differences due to the new demand, ATC separations, and terminal building compared to today's IFR1 conditions. It can also be compared to Experiment No. 1 to examine differences between 1982 VFR1 and IFR1.

Length and Level of Detail of Simulation Run:

From 0800 to 2200 hours with 15-minute summaries.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment 1000-1300 Peak[b]	Experiment No. 2A 0900-1200 Average	Experiment No. 2A 0900-1200 Peak[b]
Arrival	Runway Delay (min)	25.5	19.3	23.8	29.1
Arrival	Taxi-In Delay (min)[c]	0.1	0.1	0.7	0.6
Arrival	Gate Delay (min)	0.02	0.0	0.6	0.1
Departure	Runway Delay (min)	10.2	14.1	9.9	8.8
Departure	Taxi-Out Delay (min)[c]	0.4	0.2	0.8	0.5
Departure	Gate Delay (min)	2.6	2.2	2.2	1.6

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 3

Objective:

To obtain delay estimates in IFR2 weather with the 1982 demand, Midfield Terminal, and near-term ATC separations for the following runway-use configuration:

Arrival Runways	Departure Runways
9R	8, 9L

Related Comparison Experiments:

The results of this experiment can be compared to the results of Experiment No. 2 to examine differences between 1982 IFR1 and IFR2.

Length and Level of Detailed of Simulation Run:

From 0800 to 2200 with 1-hour output summaries.

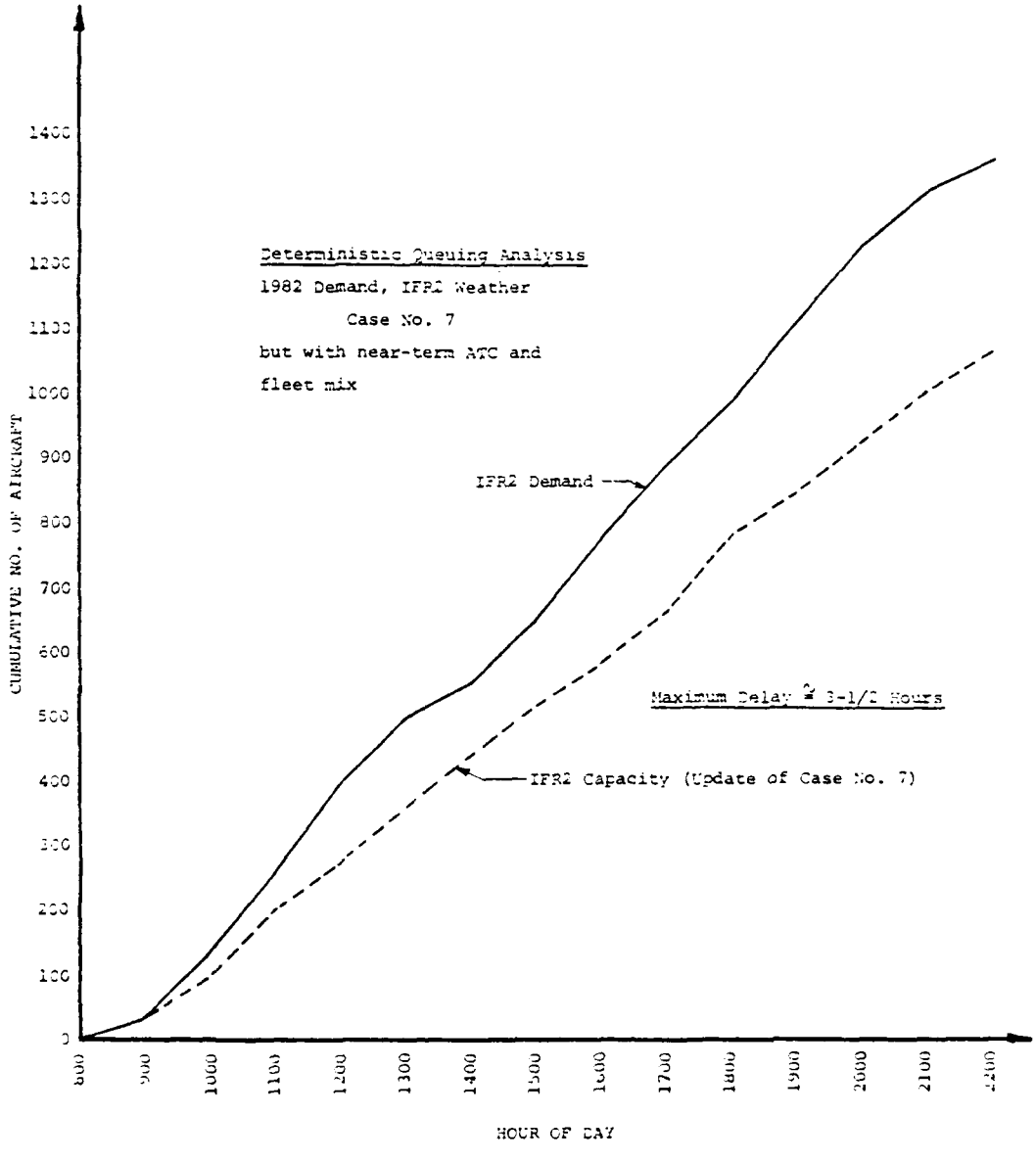
Results: (See attached figure for graphical corroboration of delay results)

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment 1000-1300 Peak[b]
Arrival	Runway Delay (min)	60+	60+
Arrival	Taxi-In Delay (min)[c]	0.1	0.1
Arrival	Gate Delay (min)	0.0	0.0
Departure	Runway Delay (min)	0.5	0.3
Departure	Taxi-Out Delay (min)[c]	0.2	0.1
Departure	Gate Delay (min)	0.0	0.0

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

ATLANTA TASK FORCE DELAY STUDY

Experiment No. 3



EXPERIMENT NO. 5

Objective

To obtain delay estimates in IFR1 weather associated with 2.0 nautical mile staggered arrival-arrival separations proposed for use when simultaneous, independent arrivals cannot be accommodated on the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment, in particular arrival flow rates and delays, can be compared with the results of Experiment No. 2.

Length and Level of Detail of Simulation Run:

From 0800 to 1300 with 15-minute output summaries.

Results:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment 1000-1300 Peak[b]	Experiment No. 2 1000-1300 Average[a]	Experiment No. 2 1000-1300 Peak[b]
Arrival	Runway Delay (min)	60+	60+	25.5	19.3
Arrival	Taxi-In Delay (min)[c]	0.1	0.1	0.1	0.1
Arrival	Gate Delay (min)	0.0	0.0	0.02	0.0
Departure	Runway Delay (min)	4.8	6.7	10.2	14.1
Departure	Taxi-Out Delay (min)[c]	0.1	0.1	0.4	0.2
Departure	Gate Delay (min)	0.0	0.0	2.6	2.2

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 6

Objective:

To obtain delay estimates in IFR1 weather associated with 1.5 nautical mile staggered arrival-arrival separations proposed for use when simultaneous, independent arrivals cannot be accommodated on the following runway-use configuration:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

The results of this experiment, in particular arrival flow rates and delays, can be compared with the results of Experiments No. 2 and No. 5.

Length and Level of Detail of Simulation Run:

From 0800 to 1300 with 15-minute output summaries.

Results:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment 1000-1300 Peak[b]	Experiment No. 5 1000-1300 Average[a]	Experiment No. 5 1000-1300 Peak[b]
Arrival	Runway Delay (min)	43.5	36.1	60+	60+
Arrival	Taxi-In Delay (min)[c]	0.1	0.1	0.1	0.1
Arrival	Gate Delay (min)	0.0	0.0	0.0	0.0
Departure	Runway Delay (min)	12.1	19.4	4.8	6.7
Departure	Taxi-Out Delay (min)[c]	0.1	0.1	0.1	0.1
Departure	Gate Delay (min)	1.6	1.2	0.0	0.0

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

Attachment B

RESULTS OF STAGE-2 DELAY SIMULATIONS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

December 1978

Table B-1

ATLANTA TASK FORCE DELAY STUDIES
ORGANIZATION OF STAGE-2
AIRFIELD SIMULATION MODEL EXPERIMENTS
AND
INDEX TO STAGE-2 RESULTS

Sequence No.	Experiment No.*	Model	Runways		Weather	Demand	ATC	Improvement	Index: Page
			Arrivals	Departures					
1	28	ASM	8, 9R	8, 9L	IFR1	1978	Today's	Existing	13
2	22	ASM	8, 9R	8, 9L	IFR1	1982	Near	Pre-1985	14
3	17	ASM	8R, 9L	8L, 9R	IFR1	1982	Near	Pre-1985	15
4	18	ASM	8L, 9R	8R, 9L	IFR1	1982	Near	Pre-1985	16
5	19	ASM	8, 9R	8, 9L	IFR1	1987	Far	Pre-1985	17
6	20	ASM	8L, 9R	8R, 9L	IFR1	1987	Far	Post-1985	18
7	21	ASM	8L, 9R	8R, 9L	VFR1	1987	Far	Post-1985	19

*Refers to numbers agreed to at Atlanta Task Force Meeting No. 4, July 12, 1978, the Subgroup Meeting of August 25, 1978, and the changes identified on September 25, 1978, at the fifth Task Force Meeting.

EXPERIMENT NO. 28

Objective

To obtain 1978 delay estimates assuming that there are two departure tracks on Runway 9L, i.e., no environmental constraints on 9L, for the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Results of this experiment can be compared to the results of Experiment No. 2A of Stage 1 to evaluate benefits of relieving single departure track constraint.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Anticipated Results:

Lower departure delays than in Experiment 2A.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 0900-1200 Average[a]	This Experiment Peak[b]	Experiment No. 2A 0900-1200 Average[a]	Experiment No. 2A Peak[b]
Arrival	Runway Delay (min)	23.6	28.6	23.8	29.1
Arrival	Taxi-In Delay (min)[c]	0.7	0.7	0.7	0.6
Arrival	Gate Delay (min)	0.6	0.1	0.6	0.1
Departure	Runway Delay (min)	8.9	7.7	9.9	8.8
Departure	Taxi-Out Delay (min)[c]	0.6	0.4	0.8	0.5
Departure	Gate Delay (min)	2.1	1.3	2.2	1.6

a. Average over the period 0900-1200 hours.
b. For the peak-demand hour, 1000-1100 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 22

Objective:

To obtain delay estimates for the case where there are no gateholds in 1982 at Midfield Terminal with near-term ATC separations and the following runway use in IFR1 weather:

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment No. 2 estimates the delays associated with an assumed gatehold procedure where aircraft are held at the gates when the length of departure queue reaches 10 aircraft.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Anticipated Results:

Reduced departure gate delays compared to Experiment 2.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment Peak[b]	Experiment No. 2 1000-1300 Average[a]	Experiment No. 2 Peak[b]
Arrival	Runway Delay (min)	25.5	19.4	25.5	19.3
Arrival	Taxi-In Delay (min)[c]	0.1	0.2	0.1	0.1
Arrival	Gate Delay (min)	0.02	0.0	0.02	0.0
Departure	Runway Delay (min)	9.5	14.1	10.2	14.1
Departure	Taxi-Out Delay (min)[c]	0.2	0.1	0.4	0.2
Departure	Gate Delay (min)	0.0	0.0	2.6	2.2

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 17

Objective:

To obtain delay estimates for 1982 demand, near-term ATC, Midfield Terminal, and the fourth runway, 8L-26R, where the "inboard" runways are used for arrivals in IFR1 weather.

Arrival Runways	Departure Runways
8R, 9L	8L, 9R

Related Comparison Experiments:

Experiment No. 18 estimates the delay for the same case but with arrivals on the "outboard" runways. Experiment No. 20 also has arrivals on the "outboard" runways, but in 1987. Experiment No. 2 is the corresponding 3-runway case.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	Peak[b]
Arrival	Runway Delay (min)	30.6	22.7
Arrival	Taxi-In Delay (min)[c]	0.3	0.2
Arrival	Gate Delay (min)	0.0	0.0
Arrival	Taxi-In Time (min)	6.5	6.3
Departure	Runway Delay (min)	1.2	1.1
Departure	Taxi-Out Delay (min)[c]	0.6	0.4
Departure	Gate Delay (min)	0.0	0.0
Departure	Taxi-Out Time (min)	6.5	6.9

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 18

Objective:

To obtain delay estimates for 1982 demand, near-term ATC, Midfield Terminal, and the fourth runway, 8L-26R, where the "outboard" runways are used for arrivals with the following runway use in IFR1 weather.

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 17 estimates the delay for the same case but with arrivals, on the "inboard" runways. Experiment No. 20 is for "outboard" case but with 1987 demand and ATC scenario. Experiment No. 2 is the corresponding 3-runway case.

Length and Level of Detail of Simulation Run:

0800 to 1300 hours with 15-minute summaries.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 1000-1300 Average[a]	This Experiment 1000-1300 Peak[b]	Experiment No. 17 1000-1300 Average[a]	Experiment No. 17 1000-1300 Peak[b]
Arrival	Runway Delay (min)	30.4	23.0	30.6	22.7
Arrival	Taxi-In Delay (min)[c]	0.2	0.2	0.3	0.2
Arrival	Gate Delay (min)	0.0	0.0	0.0	0.0
Arrival	Taxi-In Time (min)	6.1	5.94	6.5	6.3
Departure	Runway Delay (min)	1.5	1.1	1.2	1.1
Departure	Taxi-Out Delay (min)[c]	0.5	0.4	0.6	0.4
Departure	Gate Delay (min)	0.0	0.0	0.0	0.0
Departure	Taxi-Out Time (min)	5.6	6.5	6.5	6.9

a. Average over the period 1000-1300 hours.
b. For the peak-demand hour, 1100-1200 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 19

Objective:

To obtain delay estimates for 1987 demand, far-term ATC, Midfield Terminal, and the following runway use in IFR1 weather.

Arrival Runways	Departure Runways
8, 9R	8, 9L

Related Comparison Experiments:

Experiment No. 2 estimates the delays for the same conditions in 1982. Experiment No. 20 has the same 1987 demand and ATC but with the fourth runway, 8L-26R, and arrivals on the "outboard" runways.

Length and Level of Detail of Simulation Run:

0800 to 2200 hours with 15-minute summaries.

Anticipated Results:

Lower flow rates and greater runway delays than in Experiment No. 20.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 0900-1200 Average[a]	Peak[b]
Arrival	Runway Delay (min)	20.3	24.3
Arrival	Taxi-In Delay (min)[c]	0.2	0.2
Arrival	Gate Delay (min)	0.03	0.02
Departure	Runway Delay (min)	12.4	12.0
Departure	Taxi-Out Delay (min)[c]	0.6	0.6
Departure	Gate Delay (min)	1.1	0.6

a. Average over the period 0900-1200 hours.
b. For the peak-demand hour, 1000-1100 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 20

Objective:

To obtain delay estimates for 1987 demand, far-term ATC, Midfield Terminal, the fourth runway, 8L-26R, and the following runway use in IFR1 weather.

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 18 estimates the delays for the same conditions in 1982. Experiment No. 19 has the same 1987 demand and ATC, but without the fourth runway.

Length and Level of Detail of Simulation Run:

0800 to 2200 hours with 15-minute summaries.

Anticipated Results:

Greater flow rates and lower delays than in Experiment 19.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 0900-1200 Average[a]	This Experiment Peak[b]	Experiment No. 19 0900-1200 Average[a]	Experiment No. 19 Peak[b]
Arrival	Runway Delay (min)	15.2	23.3	20.3	24.3
Arrival	Taxi-In Delay (min)[c]	0.2	0.2	0.2	0.2
Arrival	Gate Delay (min)	0.2	0.2	0.03	0.02
Departure	Runway Delay (min)	2.2	3.3	12.4	12.0
Departure	Taxi-Out Delay (min)[c]	0.3	0.7	0.6	0.6
Departure	Gate Delay (min)	0.0	0.0	1.1	0.6

a. Average over the period 0900-1200 hours.
b. For the peak-demand hour, 1000-1100 hours.
c. Includes runway crossing delay, if any.

EXPERIMENT NO. 21

Objective:

To obtain delay estimates for 1987 demand, far-term ATC, Midfield Terminal, the fourth runway, 8L-26R, and the following runway use in VFR1 weather.

Arrival Runways	Departure Runways
8L, 9R	8R, 9L

Related Comparison Experiments:

Experiment No. 20 has the same conditions but in IFR1 weather.

Length and Level of Detail of Simulation Run:

0800 to 2200 hours with 1-hour summaries.

Anticipated Results:

Higher flow rates and lower delays than in Experiment 20.

Summary Comparison:

Operation Type	Performance Measure	This Experiment 0900-1200 Average[a]	This Experiment 0900-1200 Peak[b]
Arrival	Runway Delay (min)	12.0	19.9
Arrival	Taxi-In Delay (min)[c]	0.2	0.3
Arrival	Gate Delay (min)	0.2	0.6
Departure	Runway Delay (min)	1.4	2.9
Departure	Taxi-Out Delay (min)[c]	0.3	0.6
Departure	Gate Delay (min)	0.0	0.0

a. Average over the period 0900-1200 hours.
b. For the peak-demand hour, 1000-1100 hours.
c. Includes runway crossing delay, if any.

Attachment C

RESULTS OF ANNUAL DELAY EXPERIMENTS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

December 1978

Table C-1

LIST OF ANNUAL DELAY MODEL (ADM) EXPERIMENTS
AND INDEX TO RESULTS

Sequence No.	Experiment No.	Demand	ATC System	Terminal	No. of Runways	Page
1	12	1978	Today	Old	3	22
2	16	1982	Today	Old	3	25
3	14	1982	Near-Term	Old	3	28
4	15	1982	Today	New	3	31
5	13	1982	Near-Term	New	3	34
6	27	1987	Today	Old	3	37
7	25	1987	Far-Term	Old	3	40
8	26	1987	Today	New	4	43
9	24	1987	Far-Term	New	4	46
10	23	1982	Near-Term	New	6 mo. - 3 6 mo. - 2	49

Attachment D

SUMMARIES OF EXPERIMENT RESULTS

William B. Hartsfield Atlanta International Airport

Airport Improvement Task Force Delay Studies

Peat, Marwick, Mitchell & Co.
San Francisco, California

December 1978

AIRPORT STUDY CONDITIONS
ATL 1973 BASELINE (15)

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	10.26
.1	TO	.2	10.05
.2	TO	.3	.09
.3	TO	.4	10.37
.4	TO	.5	11.37
.5	TO	.6	11.76
.6	TO	.7	3.51
.7	TO	.8	10.38
.8	TO	.9	13.71
.9	TO	1.0	6.33
1.0	TO	1.1	1.53
1.1	TO	1.2	2.68
1.2	TO	1.3	.43
1.3	TO	1.5	.51
1.5	TO	1.5	.26

MEAN OF D/C RATIO = .55
STANDARD DEVIATION = .31

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	3.183
.2	TO	.4	.570
.4	TO	.6	3.632
.6	TO	.8	5.343
.8	TO	1.0	7.918
1.0	TO	1.2	4.125
1.2	TO	1.4	3.769
1.4	TO	1.6	4.415
1.6	TO	1.8	3.809
1.8	TO	2.0	2.321
2.0	TO	3.0	9.773
3.0	TO	4.0	13.670
4.0	TO	5.0	12.954
5.0	TO	6.0	9.612
6.0	TO	7.0	7.296
7.0	TO	8.0	1.008
8.0	TO	9.0	1.211
9.0	TO	10.0	.677
10.0	TO	11.0	.324
11.0	TO	12.0	.052
12.0	TO	13.0	.548
13.0	TO	14.0	.713
14.0	TO	15.0	.500
15.0	TO	16.0	.200
16.0	TO	17.0	.210
17.0	TO	18.0	.102
20.0	TO	21.0	.122
28.0	TO	29.0	.297
29.0	TO	30.0	.341
60.0	TO	61.0	.195
65.0	TO	66.0	.247
79.0	TO	80.0	.110
80.0	TO	81.0	.058
83.0	TO	84.0	.042
84.0	TO	85.0	.168
85.0	TO	86.0	.063
86.0	TO	87.0	.063
87.0	TO	88.0	.033
92.0	TO	93.0	.206
93.0	TO	94.0	.110

MEAN OF AVERAGE DELAY = 4.50
STANDARD DEVIATION = 3.46

AVG. PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	30.4	6.3	0	0
2	7.6	13.6	7	5
3	.8	0.0	0	0
1	58.2	6.4	0	0
2	2.9	16.3	7	5
3	.2	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	20.2	15.3	13.3	48.8
2	36.7	11.2	3.3	51.2
TOTAL	56.9	26.5	16.6	100.0

****

ANNUAL DELAY = 40052.62 HOURS
ANNUAL DEMAND = 534586 OPERATIONS
AVERAGE DELAY = 4.50 MINUTES/AIRCRAFT

****

* AIRPORT SNOW CONDITIONS *
* AIL NOT EXPT 16 *

WARNING -- DEMAND CANNOT BE DISSIPATED IN 24 HOUR PERIOD
REVISE HOURLY DEMAND DISTRIBUTION

WARNING -- DEMAND CANNOT BE DISSIPATED IN 24 HOUR PERIOD
REVISE HOURLY DEMAND DISTRIBUTION

WARNING -- DEMAND CANNOT BE DISSIPATED IN 24 HOUR PERIOD
REVISE HOURLY DEMAND DISTRIBUTION

WARNING -- DEMAND CANNOT BE DISSIPATED IN 24 HOUR PERIOD
REVISE HOURLY DEMAND DISTRIBUTION

****

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.33
.1	TO	.2	8.62
.2	TO	.3	3.68
.3	TO	.4	4.50
.4	TO	.5	3.52
.5	TO	.6	11.40
.6	TO	.7	10.75
.7	TO	.8	6.32
.8	TO	.9	5.28
.9	TO	1.0	13.67
1.0	TO	1.1	8.52
1.1	TO	1.2	3.65
1.2	TO	1.3	5.68
MORE THAN		1.5	.67

MEAN OF D/C RATIO = .65
STANDARD DEVIATION = .37

AVERAGE DELAY (SECONDS) AT LEAST		LESS THAN	PROBABILITY OF OCCURRENCE
0.0	TO	.2	2.125
.2	TO	.4	1.362
.4	TO	.6	1.440
.6	TO	.8	2.329
.8	TO	1.0	3.003
1.0	TO	1.2	2.506
1.2	TO	1.4	7.007
1.4	TO	1.6	3.220
1.6	TO	1.8	.521
1.8	TO	2.0	.885
2.0	TO	3.0	6.663
3.0	TO	4.0	2.708
4.0	TO	5.0	4.165
5.0	TO	6.0	1.985
6.0	TO	7.0	15.068
7.0	TO	8.0	19.752
8.0	TO	9.0	14.481
9.0	TO	10.0	.639
10.0	TO	11.0	.034
11.0	TO	12.0	.032
12.0	TO	13.0	.187
13.0	TO	14.0	.161
14.0	TO	15.0	.088
26.0	TO	27.0	.049
28.0	TO	29.0	.105
29.0	TO	30.0	.051
30.0	TO	31.0	.115
31.0	TO	32.0	.051
32.0	TO	33.0	.059
68.0	TO	69.0	.479
70.0	TO	71.0	.615
71.0	TO	72.0	1.170
72.0	TO	73.0	.799
73.0	TO	74.0	1.347
74.0	TO	75.0	1.526
76.0	TO	77.0	1.532
77.0	TO	78.0	.335
89.0	TO	90.0	.012
90.0	TO	91.0	.012
94.0	TO	95.0	.068
95.0	TO	96.0	.014
96.0	TO	97.0	.102
MORE THAN		100.0	.608

MEAN OF AVERAGE DELAY = 11.21
STANDARD DEVIATION = 7.27

AVERAGE PEAK HOUR DAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	44.3	8.2	3	2
1	2	5.2	77.7	13	15
1	3	.5	0.0	0	0
2	1	44.3	3.4	2	1
2	2	5.2	74.4	13	15
2	3	.5	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	19.9	27.5	3.9	51.3
2	18.5	26.3	3.8	48.7
TOTAL	38.4	53.9	7.7	100.0

****

ANNUAL DELAY =124644.53 HOURS
ANNUAL DEMAND = 633300 OPERATIONS
AVERAGE DELAY = 11.81 MINUTES/AIRCRAFT

****
* AIRPORT STUDY CONDITIONS *
* ATL ADP1 EXPT 14 *
****

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ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.60
.1	TO	.2	8.68
.2	TO	.3	3.56
.3	TO	.4	4.61
.4	TO	.5	9.30
.5	TO	.6	13.86
.6	TO	.7	8.67
.7	TO	.8	6.97
.8	TO	.9	6.34
.9	TO	1.0	17.82
1.0	TO	1.1	5.57
1.1	TO	1.2	.84
1.2	TO	1.3	4.51
1.4	TO	1.5	.19
MORE THAN		1.5	.57

MEAN OF D/C RATIO = .62
STANDARD DEVIATION = .35

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	PERCENT OCCURRENCE
0.0	TO	.2	2.030
.2	TO	.4	1.540
.4	TO	.6	1.758
.6	TO	.8	2.295
.8	TO	1.0	4.469
1.0	TO	1.2	6.362
1.2	TO	1.4	5.561
1.4	TO	1.6	.625
1.6	TO	1.8	.741
1.8	TO	2.0	3.482
2.0	TO	3.0	10.741
3.0	TO	4.0	3.461
4.0	TO	5.0	2.620
5.0	TO	6.0	12.330
6.0	TO	7.0	14.512
7.0	TO	8.0	14.673
8.0	TO	9.0	3.038
9.0	TO	10.0	.529
10.0	TO	11.0	.084
11.0	TO	12.0	.054
12.0	TO	13.0	.089
13.0	TO	14.0	.045
14.0	TO	15.0	.052
15.0	TO	16.0	.043
16.0	TO	17.0	.054
17.0	TO	18.0	.183
18.0	TO	19.0	.217
19.0	TO	20.0	.499
20.0	TO	21.0	.244
21.0	TO	22.0	.557
22.0	TO	23.0	.352
23.0	TO	24.0	.045
67.0	TO	68.0	1.351
69.0	TO	70.0	.680
70.0	TO	71.0	.785
71.0	TO	72.0	3.053
82.0	TO	83.0	.077
83.0	TO	84.0	.026
89.0	TO	90.0	.180
94.0	TO	95.0	.499
95.0	TO	96.0	.103

MEAN OF AVERAGE DELAY = 9.28
STANDARD DEVIATION = 6.41

AVERAGE PEAK HOUR DELAY FOR
[redacted]

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	44.3	9.1	2	1
1	2	5.2	67.5	17	15
1	3	.5	0.0	0	0
2	1	44.3	7.8	2	1
2	2	5.2	71.7	16	15
2	3	.5	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	20.8	28.4	4.4	53.6
2	20.1	21.8	4.4	46.4
TOTAL	40.9	50.2	8.8	100.0

****

ANNUAL DELAY = 97918.45 HOURS
ANNUAL DEMAND = 633300 OPERATIONS
AVERAGE DELAY = 9.28 MINUTES/AIRCRAFT

****
* AIRPORT STUDY CONDITIONS *
* ATL ADM EXPT 15 *
****

****

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.37
.1	TO	.2	11.20
.2	TO	.3	1.26
.3	TO	.4	8.78
.4	TO	.5	7.66
.5	TO	.6	12.51
.6	TO	.7	7.87
.7	TO	.8	6.78
.8	TO	.9	8.75
.9	TO	1.0	12.24
1.0	TO	1.1	8.20
1.1	TO	1.2	.63
1.2	TO	1.3	5.07
MORE THAN		1.5	.67

MEAN OF D/C RATIO = .61
STANDARD DEVIATION = .35

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	2.329
.2	TO	.4	1.281
.4	TO	.6	2.099
.6	TO	.8	5.262
.8	TO	1.0	1.692
1.0	TO	1.2	8.186
1.2	TO	1.4	3.502
1.4	TO	1.6	.658
1.6	TO	1.8	3.715
1.8	TO	2.0	2.056
2.0	TO	3.0	9.469
3.0	TO	4.0	2.045
4.0	TO	5.0	2.803
5.0	TO	6.0	9.234
6.0	TO	7.0	14.375
7.0	TO	8.0	19.724
8.0	TO	9.0	2.108
9.0	TO	10.0	.205
11.0	TO	12.0	.075
13.0	TO	14.0	.417
14.0	TO	15.0	.315
31.0	TO	32.0	.487
33.0	TO	34.0	.090
63.0	TO	64.0	.939
67.0	TO	68.0	3.007
68.0	TO	69.0	3.025
89.0	TO	90.0	.025
93.0	TO	94.0	.052
94.0	TO	95.0	.028
95.0	TO	96.0	.192
MORE THAN		100.0	.608

MEAN OF AVERAGE DELAY = 9.75
STANDARD DEVIATION = 6.77

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	88.5	8.1	2	1
1	2	10.5	68.7	17	15
1	3	1.0	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	38.8	51.9	9.2	100.0
TOTAL	38.8	51.9	9.2	100.0

****

ANNUAL DELAY =102952.59 HOURS
ANNUAL DEMAND = 633300 OPERATIONS
AVERAGE DELAY = 9.75 MINUTES/AIRCRAFT

* AIRPORT STUDY CONDITIONS *
* ATL ADM EXPT 13 *

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.86
.1	TO	.2	11.45
.2	TO	.3	.79
.3	TO	.4	9.31
.4	TO	.5	10.62
.5	TO	.6	9.15
.6	TO	.7	12.17
.7	TO	.8	6.79
.8	TO	.9	17.70
.9	TO	1.0	9.97
1.0	TO	1.1	1.14
1.1	TO	1.2	3.03
1.2	TO	1.3	.36
1.4	TO	1.5	.10
MORE THAN 1.5			.57

MEAN OF D/C RATIO = .58
STANDARD DEVIATION = .32

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	2.533
.2	TO	.4	1.144
.4	TO	.6	2.072
.6	TO	.8	5.759
.8	TO	1.0	5.687
1.0	TO	1.2	6.916
1.2	TO	1.4	.561
1.4	TO	1.6	3.851
1.6	TO	1.8	3.639
1.8	TO	2.0	2.203
2.0	TO	3.0	9.360
3.0	TO	4.0	6.221
4.0	TO	5.0	13.916
5.0	TO	6.0	15.157
6.0	TO	7.0	10.583
7.0	TO	8.0	1.609
8.0	TO	9.0	.468
9.0	TO	10.0	.105
10.0	TO	11.0	.794
12.0	TO	13.0	.610
13.0	TO	14.0	.559
16.0	TO	17.0	.453
17.0	TO	18.0	.726
18.0	TO	19.0	1.240
19.0	TO	20.0	1.557
20.0	TO	21.0	.245
81.0	TO	82.0	.051
82.0	TO	83.0	.052
89.0	TO	90.0	.179
93.0	TO	94.0	.384
95.0	TO	96.0	.206

MEAN OF AVERAGE DELAY = 5.09
STANDARD DEVIATION = 3.24

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	78.5	6.4	2	1
1	2	19.5	20.3	3	5
1	3	1.0	0.0	0	0

PERCENT DELAY OCCURRENCE BY EACH
RUNWAY USE--WEATHER CONDITION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	58.4	25.8	15.7	100.0
TOTAL	58.4	25.8	15.7	100.0

****

ANNUAL DELAY = 53755.42 HOURS
ANNUAL DEMAND = 633309 OPERATIONS
AVERAGE DELAY = 5.09 MINUTES/AIRCRAFT

****
* AIRPORT STUDY COMPUTATIONS *
* ATL APM EXPT 27 *
****

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.26
.1	TO	.2	7.92
.2	TO	.3	4.08
.3	TO	.4	.43
.4	TO	.5	5.43
.5	TO	.6	8.39
.6	TO	.7	5.26
.7	TO	.8	2.46
.8	TO	.9	2.26
.9	TO	1.0	.45
1.0	TO	1.1	2.61
1.1	TO	1.2	43.01
1.2	TO	1.3	2.12
1.3	TO	1.4	5.40
1.4	TO	1.5	1.03
MORE THAN		1.5	.88

MEAN OF D/C RATIO = .83
STANDARD DEVIATION = .45

(HOURS) AT LEAST		LESS THAN	PERCENT OCCURRENCE
0.0	TO	.2	1.754
.2	TO	.4	1.427
.6	TO	.8	.215
.8	TO	1.0	2.380
1.0	TO	1.2	2.369
1.2	TO	1.4	.053
1.4	TO	1.6	.202
1.6	TO	1.8	.612
1.8	TO	2.0	.959
2.0	TO	3.0	1.853
5.0	TO	6.0	.034
6.0	TO	7.0	1.129
7.0	TO	8.0	5.994
8.0	TO	9.0	.821
9.0	TO	10.0	.128
16.0	TO	17.0	.600
17.0	TO	18.0	.700
18.0	TO	19.0	1.026
19.0	TO	20.0	.383
21.0	TO	22.0	.323
22.0	TO	23.0	.122
23.0	TO	24.0	.132
42.0	TO	43.0	2.349
47.0	TO	48.0	2.349
48.0	TO	49.0	2.536
49.0	TO	50.0	2.536
50.0	TO	51.0	2.458
52.0	TO	53.0	8.163
54.0	TO	55.0	2.894
56.0	TO	57.0	5.234
60.0	TO	61.0	2.713
61.0	TO	62.0	12.205
62.0	TO	63.0	5.777
64.0	TO	65.0	2.391
65.0	TO	66.0	8.341
66.0	TO	67.0	5.886
75.0	TO	76.0	.140
76.0	TO	77.0	.109
77.0	TO	78.0	.251
78.0	TO	79.0	.219
79.0	TO	80.0	.226
80.0	TO	81.0	.217
81.0	TO	82.0	.455
82.0	TO	83.0	.931
83.0	TO	84.0	1.061
84.0	TO	85.0	1.647
85.0	TO	86.0	1.411
87.0	TO	88.0	.744
89.0	TO	90.0	.659
90.0	TO	91.0	1.684
MORE THAN		139.0	.512

MEAN OF AVERAGE DELAY = 49.05
STANDARD DEVIATION = 43.21

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	44.3	65.7	17	15
1	2	5.2	90.9	23	15
1	3	.5	0.0	0	0
2	1	44.3	66.2	16	15
2	2	5.2	85.6	23	15
2	3	.5	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	43.0	8.9	1.1	53.0
2	37.4	8.5	1.1	47.0
TOTAL	80.4	17.4	2.2	100.0

****

ANNUAL DELAY =615810.38 HOURS
ANNUAL OPERATIONS = 753300 OPERATIONS
AVERAGE DELAY = 49.0 MINUTES/AIRCRAFT

****
* AIRPORT STUDY CONDITIONS *
* ATL ADM EXPT 25 *
****

****

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.33
.1	TO	.2	8.78
.2	TO	.3	3.72
.3	TO	.4	5.20
.4	TO	.5	11.99
.5	TO	.6	5.13
.6	TO	.7	11.43
.7	TO	.8	4.59
.8	TO	.9	8.63
.9	TO	1.0	14.51
1.0	TO	1.1	3.13
1.1	TO	1.2	13.71
1.2	TO	1.3	.12
1.4	TO	1.5	.23
MORE THAN		1.5	.40

MEAN OF D/C RATIO = .64
STANDARD DEVIATION = .36

AVERAGE DELA (MINUTES) AT LEAST		LESS THAN	DISTRIBU. OF PERCENT OCCURRENCE
0.0	TO	.2	2.155
.2	TO	.4	1.519
.4	TO	.6	1.404
.6	TO	.8	5.570
.8	TO	1.0	2.657
1.0	TO	1.2	1.536
1.2	TO	1.4	2.159
1.4	TO	1.6	3.596
1.6	TO	1.8	2.816
1.8	TO	2.0	3.642
2.0	TO	3.0	4.058
3.0	TO	4.0	3.242
4.0	TO	5.0	6.647
5.0	TO	6.0	12.478
6.0	TO	7.0	12.657
7.0	TO	8.0	4.644
8.0	TO	9.0	6.209
9.0	TO	10.0	7.159
10.0	TO	11.0	2.624
11.0	TO	12.0	.909
16.0	TO	17.0	4.417
29.0	TO	30.0	.449
30.0	TO	31.0	.614
32.0	TO	33.0	.430
34.0	TO	35.0	.788
35.0	TO	36.0	.650
36.0	TO	37.0	.468
37.0	TO	38.0	.740
38.0	TO	39.0	.614
51.0	TO	52.0	.783
54.0	TO	55.0	.717
56.0	TO	57.0	.817
81.0	TO	82.0	.074
82.0	TO	83.0	.025
84.0	TO	85.0	.087
85.0	TO	86.0	.087
88.0	TO	89.0	.130
89.0	TO	90.0	.367

MEAN OF AVERAGE DELAY = 8.55
STANDARD DEVIATION = 6.07

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	44.3	16.1	5	3
1	2	5.2	56.7	16	15
1	3	.5	0.0	0	0
2	1	44.3	16.9	2	1
2	2	5.2	37.8	14	11
2	3	.5	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	29.0	21.7	4.2	54.9
2	27.3	13.6	4.2	45.1
TOTAL	56.3	35.3	8.4	100.0

****

ANNUAL DELAY =107388.65 HOURS
ANNUAL DEMAND = 753300 OPERATIONS
AVERAGE DELAY = 8.55 MINUTES/AIRCRAFT

****
* AIRPORT STUDY CONDITIONS *
* ATL ADM EXPT 26 *
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****

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	10.18
.1	TO	.2	10.18
.2	TO	.3	1.95
.3	TO	.4	11.15
.4	TO	.5	8.34
.5	TO	.6	5.52
.6	TO	.7	11.13
.7	TO	.8	13.22
.8	TO	.9	3.50
.9	TO	1.0	2.17
1.0	TO	1.1	4.65
1.1	TO	1.2	3.64
1.2	TO	1.3	2.12
1.3	TO	1.4	6.93
1.4	TO	1.5	.28

MEAN OF D/C RATIO = .60
STANDARD DEVIATION = .38

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	3.483
.2	TO	.4	.659
.4	TO	.6	6.013
.6	TO	.8	4.868
.8	TO	1.0	3.287
1.0	TO	1.2	2.036
1.2	TO	1.4	1.171
1.4	TO	1.6	2.307
1.6	TO	1.8	2.868
1.8	TO	2.0	2.892
2.0	TO	3.0	21.095
3.0	TO	4.0	4.475
4.0	TO	5.0	4.815
5.0	TO	6.0	9.588
6.0	TO	7.0	13.830
7.0	TO	8.0	.124
8.0	TO	9.0	4.320
9.0	TO	10.0	.894
14.0	TO	15.0	.010
17.0	TO	18.0	.036
21.0	TO	22.0	.009
23.0	TO	24.0	.019
24.0	TO	25.0	.010
68.0	TO	69.0	.578
69.0	TO	70.0	.565
70.0	TO	71.0	.170
71.0	TO	72.0	.549
74.0	TO	75.0	5.520
75.0	TO	77.0	2.571
77.0	TO	78.0	.177

MEAN OF AVERAGE DELAY = 10.65
STANDARD DEVIATION = 7.60

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	44.3	6.6	0	0
1	2	5.2	74.9	19	15
1	3	.5	0.0	0	0
2	1	44.3	9.1	2	1
2	2	5.2	74.9	19	15
2	3	.5	0.0	0	0

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	5.0	33.3	2.4	44.7
2	19.7	33.3	2.4	55.3
TOTAL	25.7	66.5	4.8	100.0

****

ANNUAL DELAY =133716.06 HOURS
ANNUAL DEMAND = 753300 OPERATIONS
AVERAGE DELAY = 10.65 MINUTES/AIRCRAFT

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*   AIRPORT STUDY CONDITIONS   *
*       ATL ADH EXPT 24        *
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ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	14.01
.1	TO	.2	6.38
.2	TO	.3	10.84
.3	TO	.4	9.60
.4	TO	.5	10.07
.5	TO	.6	14.12
.6	TO	.7	15.36
.7	TO	.8	4.42
.8	TO	.9	6.25
.9	TO	1.0	6.00
1.0	TO	1.1	.91
1.1	TO	1.2	2.05

MEAN OF D/C RATIO = .48
STANDARD DEVIATION = .29

AVERAGE DELAY   DISTRIBUTION

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	3.552
.2	TO	.4	9.032
.4	TO	.6	6.004
.6	TO	.8	6.402
.8	TO	1.0	4.870
1.0	TO	1.2	7.296
1.2	TO	1.4	11.577
1.4	TO	1.6	12.593
1.6	TO	1.8	3.439
1.8	TO	2.0	2.484
2.0	TO	3.0	5.071
3.0	TO	4.0	7.967
4.0	TO	5.0	6.829
5.0	TO	6.0	4.422
6.0	TO	7.0	3.366

MEAN OF AVERAGE DELAY = 2.15
STANDARD DEVIATION = 1.53

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HRS.
1	1	44.3	3.3	0	0
1	2	5.2	6.9	4	3
1	3	.5	0.0	0	0
2	1	44.3	6.6	2	1
2	2	5.2	5.9	4	3
2	3	.5	0.0	0	0

PERCENT DELAY OCCURRENCE OF EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION			
	VFR	IFR1	IFR2	TOTAL
1	25.5	8.7	.5	34.8
2	56.0	8.7	.5	65.2
TOTAL	81.6	17.3	1.1	100.0

****

ANNUAL DELAY = 26971.20 HOURS
ANNUAL DEMAND = 753300 OPERATIONS
AVERAGE DELAY = 2.15 MINUTES/AIRCRAFT

****

23A

ANNUAL SUMMARY

DEMAND TO CAPACITY (D/C RATIO) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.1	8.45
.1	TO	.2	6.62
.2	TO	.3	4.38
.3	TO	.4	3.77
.4	TO	.5	1.92
.5	TO	.6	12.72
.6	TO	.7	1.02
.7	TO	.8	4.26
.8	TO	.9	3.89
.9	TO	1.0	7.09
1.0	TO	1.1	7.37
1.1	TO	1.2	28.08
MORE THAN		1.5	10.44

MEAN OF D/C RATIO = .84
STANDARD DEVIATION = .50

READ.

AVERAGE DELAY (MINUTES) AT LEAST		LESS THAN	DISTRIBUTION PERCENT OCCURRENCE
0.0	TO	.2	1.935
.2	TO	.4	1.234
.4	TO	.6	1.937
.6	TO	.8	3.170
.8	TO	1.0	1.879
1.0	TO	1.2	2.398
1.2	TO	1.4	.079
1.4	TO	1.6	.168
1.6	TO	1.8	.250
1.8	TO	2.0	.092
3.0	TO	4.0	.365
4.0	TO	5.0	.684
5.0	TO	6.0	6.770
6.0	TO	7.0	2.533
9.0	TO	10.0	4.137
10.0	TO	11.0	5.308
31.0	TO	32.0	10.357
32.0	TO	33.0	9.985
35.0	TO	36.0	10.273
39.0	TO	40.0	9.534
42.0	TO	43.0	11.940
60.0	TO	61.0	14.372

MEAN OF AVERAGE DELAY = 29.21
STANDARD DEVIATION = 10.22

AVERAGE PEAK HOUR DELAY FOR
PEAK MONTH, AVG. DAY

RUNWAY USE	WEATHER GROUP	PERCENT OCCURRENCE	PEAK HOUR AVERAGE DELAY (MINUTES)	NUMBER OF SATURATED HOURS	NUMBER OF OVERLOAD HOURS
1	1	85.5	42.4	16	11
1	2	12.5	60.0	24	22
1	3	2.0	60.0	24	15

PERCENT DELAY OCCURRENCE IN EACH
RUNWAY USE--WEATHER COMBINATION

RUNWAY USE	WEATHER CONDITION VFR	IFR1	IFR2	TOTAL
1	70.5	25.7	3.8	100.0
TOTAL	70.5	25.7	3.8	100.0

****

ANNUAL DELAY =152273.64 HOURS
ANNUAL DEMAND = 312820 OPERATIONS
AVERAGE DELAY = 29.21 MINUTES/AIRCRAFT

Telephone: (415) 347-9521

August 6, 1979

Mr. Michael J. Powderly
Chief, Atlanta Tower
Hartsfield International Airport
P. O. Box 20722
Atlanta, Georgia 30320

Re: Discussion Outline, July 23, 1979

Dear Mike:

The attached contains changes to pages 3 and 8 of the July 23, 1979, discussion outline. These changes reflect the effect of the West Operation at Atlanta which is unaffected by the proposed single departure route to the East.

The numbers now reflect that there is a higher percentage of IFR weather when the East Operation is used (22% instead of 12%) but the East Operation is used only 40% of the year.

If you have any questions on this, please let me know.

Sincerely,

W. J. Dunlay, Jr.
Senior Consultant

WJD/nlm
Enclosure

bcc: TFD Corresp.
TFD Proj ATL
S. L. M. Hockaday
(w/o encl)

William B. Hartsfield Atlanta International Airport
Task Force Delay Studies
SPECIAL DELAY SIMULATION STUDIES

Proposed Single Departure Route

Assumptions:

(1) VFR2 weather or better occurs 78% of the time that the East Operation is in use

(2) IFR1 weather or worse occurs 22% of the time that the East Operation is in use

(3) The East Operation is used approximately 40% of the year

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT
TASK FORCE DELAY STUDIES
SPECIAL DELAY SIMULATION EXPERIMENTS

WEATHER CONDITIONS: VFR2

SIMULATION PERIOD: 0400-0400 HOURS (A 24-HOUR PERIOD), EAST OPERATION

SCHEDULE: JUNE 15, 1979: 843 ARRIVALS 841 DEPARTURES

COMPARISON OF DAILY AVERAGE DELAYS - MINUTES

TYPE OF DELAY	TWO DEPARTURE STREAMS	ONE DEPARTURE STREAM	DELAY PENALTY
AVERAGE ARRIVAL AIR:	18.8	20.5	1.7
AVERAGE ARRIVAL TAXI:	0.3	0.4	0.1
AVERAGE ARRIVAL GATE:	2.1	3.2	1.1
AVERAGE ARRIVAL TOTAL:	21.2	24.1	2.9
AVERAGE DEPARTURE RUNWAY:	5.4	21.2	15.8
AVERAGE DEPARTURE TAXI:	0.6	2.8	2.2
AVERAGE DEPARTURE GATE:	0.7	9.5	8.8
AVERAGE DEPARTURE TOTAL:	6.7	33.5	26.8
TOTAL DAILY DELAY:	22,990	46,770	23,780

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT
TASK FORCE DELAY STUDIES
SPECIAL DELAY SIMULATION EXPERIMENTS

WEATHER CONDITIONS: IFR1

SIMULATION PERIOD: 0400-0400 HOURS (A 24-HOUR PERIOD), EAST OPERATION

SCHEDULE: JUNE 15, 1979: 843 ARRIVALS 841 DEPARTURES

COMPARISON OF DAILY AVERAGE DELAYS - MINUTES

TYPE OF DELAY	TWO DEPARTURE STREAMS	ONE DEPARTURE STREAM	DELAY PENALTY
AVERAGE ARRIVAL AIR:	15.9	31.0	15.1
AVERAGE ARRIVAL TAXI:	0.6	14.9	14.3
AVERAGE ARRIVAL GATE:	9.9	11.8	1.9
AVERAGE ARRIVAL TOTAL:	26.4	57.7	31.3
AVERAGE DEPARTURE RUNWAY:	50.6	61.1	10.5
AVERAGE DEPARTURE TAXI:	14.6	47.7	33.1
AVERAGE DEPARTURE GATE:	30.3	294.0	263.7
AVERAGE DEPARTURE TOTAL:	95.5	402.8	307.3
TOTAL DAILY DELAY:	101,190	373,000	271,810

William B. Hartsfield Atlanta International Airport
Task Force Delay Studies
SPECIAL DELAY SIMULATION EXPERIMENTS

VFR2 Delay Penalties with Proposed Single Departure Route - East Operation

	Delay Penalty - Minutes	Added Aircraft Operating Costs*
Average Additional per Arrival:	2.9	$49
Average Additional per Departure:	26.8	$456
Total Additional per Day (all aircraft):	23,780	$404,260

*Assuming $17.00 per minute, which is the average cost for the fleet operating at Atlanta International Airport.

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

TASK FORCE DELAY STUDIES

SPECIAL DELAY SIMULATION EXPERIMENTS

IFR1 DELAY PENALTIES WITH PROPOSED SINGLE DEPARTURE ROUTE - EAST OPERATION

	DELAY PENALTY - MINUTES	ADDED AIRCRAFT OPERATING COSTS*
AVERAGE ADDITIONAL PER ARRIVAL:	31.3	$532
AVERAGE ADDITIONAL PER DEPARTURE:	307.3	$5,224
TOTAL ADDITIONAL PER DAY (ALL AIRCRAFT):	271,810	$4,620,770

*ASSUMING $17.00 PER MINUTE, WHICH IS THE AVERAGE COST FOR THE FLEET OPERATING AT ATLANTA INTERNATIONAL AIRPORT.

WILLIAM B. HARTSFIELD ATLANTA INTERNATIONAL AIRPORT

TASK FORCE DELAY STUDIES

SPECIAL DELAY SIMULATION STUDIES

SUMMARY OF EFFECTS OF PROPOSED SINGLE DEPARTURE ROUTE - EAST OPERATION

- IN IFR1 WEATHER, 71 OF THE 841 SCHEDULED DAILY DEPARTURES CANNOT BE ACCOMMODATED IN THE 24-HOUR PERIOD, 0400-0400 HOURS
- ADDITIONAL $0.4 MILLION IN DAILY AIRCRAFT OPERATING COSTS IN VFR2 WEATHER
- ADDITIONAL $4.6 MILLION IN DAILY AIRCRAFT OPERATING COSTS IN IFR1 WEATHER
- THE TOTAL ADDITIONAL ANNUAL DELAY PENALTY OF 11.4 MILLION MINUTES[A]
- THE TOTAL ADDITIONAL ANNUAL AIRCRAFT OPERATING COST OF $193 MILLION[A]

[A]TAKES INTO ACCOUNT THAT NO ADDITIONAL PENALTY IS INCURRED IN THE WEST OPERATION, WHICH OCCURS ABOUT 60% OF THE YEAR.

Telephone: (415) 347-9521

March 11, 1980

Mr. Billy H. Drotts
Task Force Chairman
Federal Aviation Administration
Southern Region
P.O. Box 20636
Atlanta, Georgia 30320

Re: Capacity Exhibit for Atlanta Task Force Report

Dear Billy:

Enclosed is a photostat and one copy of the exhibit depicting hourly runway capacities. Note that part or all of the exhibit title block, which is on MAC-TAC, can be removed and replaced with your own labels.

This photostat should serve as a reproducible copy for the Task Force report.

If you have any questions about the exhibit please call me.

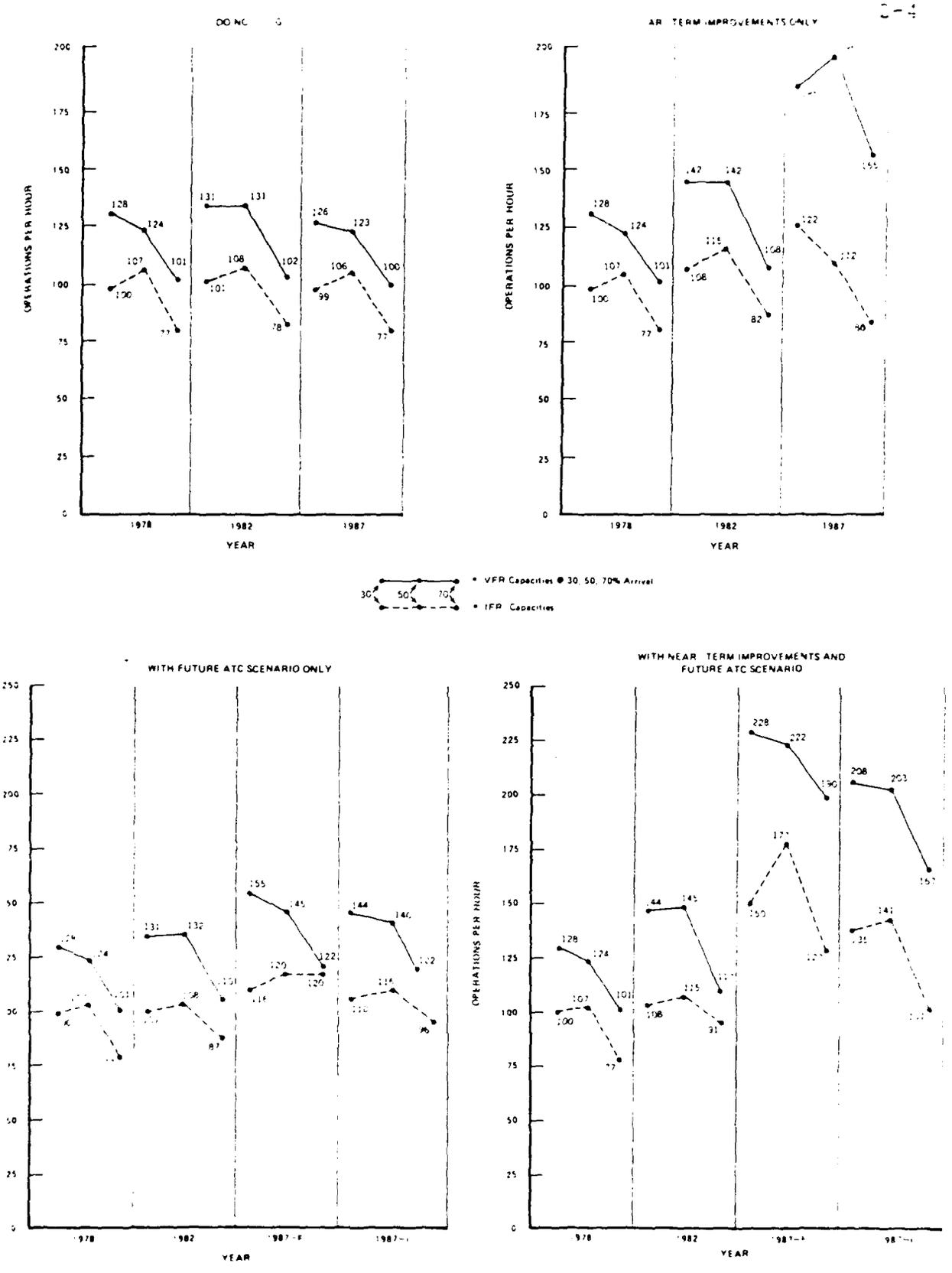
Sincerely,

William J. Dunlay, Jr.
Senior Consultant

./sa
Enclosure

cc: Mr. J. C. Orman

bcc: S. L. M. Hockaday
Atlanta TFD Project



Source: PMM & Co. estimates based on Task Force inputs.

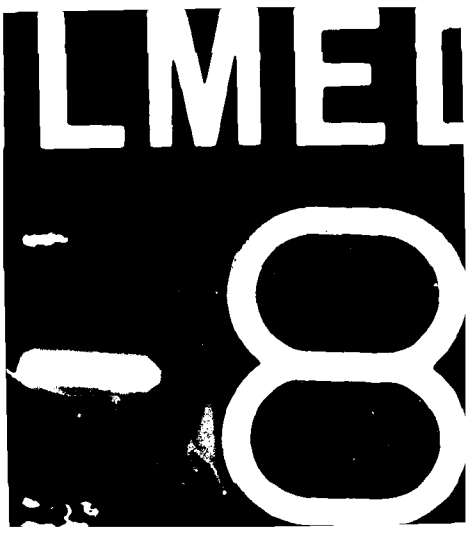
I = Intermediate Term Separations (2.5 n.m.)
F = Far Term Separations (2.0 n.m.)

Figure 2

HOURLY RUNWAY CAPACITIES AT 30%, 50%, 70% ARRIVALS

Atlanta International Airport

PMM & Co. June 1979


LMEL
8